

MD-PHYSIOLOGY

Program Outcomes:

A post graduate student having qualified the MD (Physiology) examination should be able to:

PO1. Understand and deal with all aspects of general, systemic and applied Physiology.

PO2. Teach effectively the basic physiological mechanisms of human body with reference to their implications in the pathogenesis of diseases (pathophysiology) affecting various organ systems and the physiological basis of their management to undergraduate medical, paramedical and all other basic science students.

PO3. Understand general principles of medical education (use of appropriate teaching techniques and resources).

PO4. Explain how the knowledge of physiology can be effectively used in a various clinical setting to solve diagnostic and therapeutic problems.

PO5. Interpret and evaluate research publications critically.

PO6. Use the library facilities (Literature database using computer, CD ROM, internet search and any other available newer techniques).

PO7. Conduct relevant clinical/experimental research which may have significant bearing on human health and patient care.

PO8. Interpret the research findings in the light of its basic and applied significance.

PO9. Acquire skills in conducting collaborative research in the field of physiology with allied sciences, clinical sciences and biomedical engineering.

PO10. Interact with the allied departments and render services in advanced laboratory investigations.

PO11. Serve as interface with society at large.

PO12. Acquire administrative skills to set up concerned department / laboratories and initiate purchase procedure and procure necessary items for running such laboratories.

PO13. Function as a member of a teaching or research team.

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive Domain

1. Able to teach the basic physiological mechanisms of human body with reference to their implications in the pathogenesis of diseases (pathophysiology) and their management to undergraduate medical and paramedical students.
2. Conduct such clinical and experimental research, as would have a significant bearing on human health and patient care.

3. Interact with other departments by rendering services in advanced laboratory investigations and relevant expert opinion.
4. Participate actively in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.
5. Contribute to society by imparting physiological understanding of health problems.
6. Plan a research study and conduct basic and clinical systemic investigations.

B Affective domain

1. Demonstrate self-awareness and personal development in routine conduct.
(*Self-awareness*)
2. Communicate effectively with peers, students and teachers in various teaching-learning activities. (*Communication*)
3. Demonstrate
 - a. Due respect in handling human body parts & cadavers during dissection (*Ethics & Professionalism*)
 - b. Humane touch while demonstrating living surface marking in subject/patient (*Ethics & Professionalism*)
4. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
5. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure (*Equity and social accountability*)

C. Psychomotor Domain

The student should acquire competencies in the following tasks:

I. Hematology Experiments

1. Estimation of hemoglobin
2. Determination of Total Erythrocyte (RBC) Count and RBC Indices (Blood Standards)
3. Determination of Total Leucocytes (WBC) Count : TLC
4. Preparation of a peripheral Blood Smear and Determination of Differential Leucocyte Count: DLC
5. Determination of Arneeth Count
6. Determination of Bleeding Time (BT) and Clotting Time (CT)
7. Determination of Blood groups (A,B,O and Rh system)
8. Determination of Erythrocyte Sedimentation Rate (ESR) and Packed cell volume (PCV)
9. Determination of Osmotic Fragility of Red Blood Cells
10. Determination of Platelet Count
11. Determination of Reticulocyte Count
12. Determination of Absolute Eosinophil Count
13. Study of Haemopoietic Cells Present in the Bone Marrow

II. Animal Experiments (All animal experiments must be compliant with Govt. of India Regulations, notified from time to time). Experiments in

Amphibian/Dog/Cat should be conducted by computer assisted simulation models/ facilities. Other experiments should be performed as permissible by CPCSEA guidelines.

A. Amphibian (Frog) Experiments

1. Effect of temperature on simple muscle twitch.
2. Effect of two successive stimuli (of same strength) on skeletal muscle.
3. Effect of increasing strength of stimuli on skeletal muscle.
4. Effect of increasing frequency of stimuli on skeletal muscle (genesis of tetanus).
5. Effect of free load and after load on skeletal muscle.
6. Effect of repeated stimuli on skeletal muscle (study of phenomenon of Fatigue).
7. Study of isometric contraction in skeletal muscle.
8. Determination of conduction velocity of sciatic nerve and effect of variables on it.
9. Properties of cardiac muscle – Refractory period, All-or-None Law, extra-systole and compensatory pause, beneficial effect.
10. Regulation of Heart, Vagus dissection and effect of Vagal and WCL stimulation.
11. Effect of physiological and pharmacological variables on intact frog's heart.
12. Perfusion of isolated frog's heart-role of sodium, potassium, calcium ions and drugs.
13. Perfusion of blood vessels in the frog.
14. Capillary circulation (Frog Web).

B. Mammalian Experiments (Dog/Rabbit/Guinea pig/Rat/Mice)

1. General management of mammalian experiments.
2. Recording of heart rate, blood pressure and respiration and study the effects of various factors; drugs; asphyxia; occlusion of common carotid artery.
3. Effect of stimulation of central and peripheral end of vagus on arterial blood pressure and respiration after vagotomy.
4. Effect of stimulation and distension of carotid sinus on blood pressure and respiration.
5. Effect of stimulation of splanchnic nerve.
6. Effect of stimulation of peripheral somatic nerve (sciatic nerve).
7. Study of hypovolemic shock and its reversal.
8. Perfusion of isolated mammalian heart and study the effects of drugs and ions.
9. Recording of Isolated Intestinal movement and tone and studying the effect of drugs and ions.
10. Study of various stages of menstrual cycle, cervical smear and vaginal smear.

III. Human Physiology

Clinical Physiology

1. Physiological principles of clinical examination.

2. General Physical examination, physiological basis of some clinical symptoms and signs.
3. General principles of Inspection/Palpation/Percussion/Auscultation.

Nerve muscle physiology

1. Ergography and hand grip spring dynamography and study of human fatigue.
2. Recording of electromyography (EMG) and its application.
3. Recording of nerve conduction.

Cardiovascular system (CVS)

1. Clinical examination of CVS.
2. Examination of arterial & venous pulses.
3. Measurements of arterial blood pressure and effect of head-up/head-down tilt.
4. Recording of 12 lead Electrocardiography (ECG) and its interpretation.
5. Measurement of blood flow.

Respiratory system

1. Clinical examination of respiratory system.
2. Stethography – study of respiratory movements and effect of various factors.
3. Assessment of respiratory functions (spirometry, vitalography, and gas analysis).
5. Measurement of BMR.
6. Cardio pulmonary resuscitation (CPR) and Artificial respiration.

Gastrointestinal system: Clinical examination of abdomen.

Integrative Physiology / Excretory system

1. Recording of body temperature/effect of exposure to cold and hot environment
2. Studies in stimulated environment - microgravity; high altitude; hot and cold environment.
3. Human studies involving sweat, salivation and urine.

Reproductive system

1. Determination of ovulation time by basal body temperature chart and pregnancy diagnostic test - Immunological Tests.
2. Semen analysis: sperm count and motility.

Nervous System including Special senses

1. Clinical examination of the nervous system and its physiological basis.
2. Examination of higher mental functions.
3. Examination of cranial nerves.

4. Examination of sensory system.
5. Examination of motor system including reflexes
6. Clinical examination of special senses:
 - (i) Smell and Taste
 - (ii) Test for hearing to deafness
 - (iii) Physiology of eye:
 - (a) Clinical examination of the eye and pupillary reflex
 - (b) Visual acuity
 - (c) Perimetry – mapping out of visual field and blind spot
 - (d) Accommodation
 - (e) Fundoscopy
 - (f) Colour vision and colour blindness
7. Reaction (visual and auditory) and reflex time.
8. Electroencephalography (EEG) and Polysomnography
9. Autonomic Nervous System (ANS) Testing.
10. Neuro-electrodiagnostic techniques:
 - (i) Nerve conduction study.
 - (ii) Visual evoked potential (VEP).
 - (iii) Brainstem auditory evoked potential (B.A.E.P).
 - (iv) Somato-sensory evoked potential (SEP).
 - (v) Motor evoked potential (MEP).

Others

1. Construction of dietary chart for growing children, pregnant woman, elderly individuals, hypertensive patients, & diabetes mellitus patients.
2. Tests for physical fitness: Cardio – respiratory responses to steady state exercise using
 - (i) Harvard step test
 - (ii) Bicycle Ergometry
 - (iii) Treadmill test for determination of VO₂ max

Syllabus

Course contents:

Paper-I: *General and Cellular Physiology including Genetic Basis and Historical perspectives:*

1. Physiology of cell, various cellular mechanisms and genetic control mechanisms.
2. Various principles of Physics and Physical Chemistry involved in physiological phenomenon e.g. haemo-dynamics, bio-electrical potentials, body fluids, methods of measurements.
3. History of Physiology.
4. Biostatistics, Biophysics, Biochemistry, Micro-anatomy.
5. Growth and Development including aging.

6. Excretion, pH, water and Electrolyte balance.

Paper-II: *Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology.*

1. Blood and Immunity.
2. Cardiovascular System.
3. Respiratory System.
4. Gastro- Intestinal Tract (GIT) and dietary requirements.

Paper-III: *Systemic Physiology (system concerned with procreation, regulation and neural control)*

1. Nerve-Muscle Physiology including muscle mechanics
2. Endocrine Physiology
3. Nervous System (Central, peripheral and autonomic)
4. Special Senses
5. Reproduction & family planning/foetal & neonatal Physiology

Paper-IV: *Applied Physiology including recent advances*

1. Patho-physiology pertaining to systemic Physiology
2. Physiological basis of various clinical investigation tests
3. Interaction of human body in ambient environment- high altitude, space and deep sea
4. Sports physiology
5. Yoga and Meditation
6. Recent advances relevant to Physiology
7. Social responsibilities of physiologists

Departmental resources

It is to be mandatory for the department to establish and develop the following laboratories. In addition to teaching, these laboratories should be involved in active research and in patient care services in one or more well defined fields.

1. Clinical Neurophysiology Laboratory

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

- (i) Electroencephalography

- (ii) Evoked potential recording
- (iii) Electromyography
- (iv) Nerve conduction studies
- (v) Autonomic nervous system (ANS) testing
- (vi) Any other newer technology

2. Cardio-Respiratory Laboratory

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

- (i) Electrocardiography
- (ii) Blood-gas Analysis
- (iii) Computerized multifunctional spirometry
- (iv) Laboratory for measuring pulmonary diffusion capacity and functional residual capacity (FRC)
- (v) Whole-body plethysmography
- (vi) Laboratory for Blood flow measurements (Impedence plethysmograph/Laser flow meter/ Doppler flow meter)

3. Exercise Physiology Laboratory

The department should generate liaison with sports authorities and clinical departments to provide services for testing and grading exercise and physical efficiency for health monitoring and diagnostics (disease). This should be done by using the following techniques:

- (i) Two step test exerciser
- (ii) Bicycle Ergometry
- (iii) Tread mill
- (iv) Respiratory gas analysis and measurement of basal metabolic rate (BMR)

4. Metabolic/Endocrinology/Reproductive Bio-medicine laboratory

This laboratory should perform various tests pertaining to gastrointestinal, renal, metabolic, endocrinal and reproductive bio-medicine. The department should generate liaison with clinical departments and provide routine services for health monitoring and diagnostics (disease).

- (i) Spectrophotometer
- (ii) pH meter
- (iii) Elisa Reader/Washer
- (iv) Luminometer

(v) Semi-autoanalyser

Post graduate students should be posted in the above laboratories and extend the required services on routine basis.

The Department should be equipped with general facilities like PG resource room with internet access and a departmental library with books especially those related to pertinent higher studies in Physiology and field of research. The college/department should make important journals available (at least four Indian journals and two international journals).

MD-BIOCHEMISTRY

Program Outcomes:

At the end of the MD training programme in Biochemistry, the post graduate student should have acquired competencies in the following areas, as detailed below.

PO1. Acquisition of knowledge: The student should be able to explain clearly concepts and principles of biochemistry and cell biology, including correlations of these with cellular and molecular processes involved in health and disease.

PO2. Teaching and training: The student should be able to effectively teach undergraduate students in medicine and allied health science courses so they become competent health care professionals and able to contribute to training of postgraduate post graduate students.

PO3. Diagnostic services: The student should be able to set up/supervise/manage a diagnostic laboratory in Biochemistry in a hospital, ensuring quality control, and providing a reliable support service. The student should be able to provide clinicians with consultation services for diagnostic tests in biochemistry and in interpretation of laboratory results.

PO4. Research: The student should be able to carry out a research project from planning to publication and be able to pursue academic interests and continue life-long learning to become more experienced in all the above areas and to eventually be able to guide postgraduates in their thesis work.

SUBJECT SPECIFIC COMPETENCIES

The student during the training programme should acquire the following competencies:

A. Cognitive domain

1. Describe and apply biochemical principles to explain the normal state, abnormal disease conditions and mechanism of action used in the perception, diagnosis and

treatment of diseases.

2. Explain energy transactions in a living system, and describe importance of biomolecules in sustaining the life process.
3. Describe pathways of the intermediary metabolism along with their individual and integrated regulation and apply that in understanding the functioning of the body.
4. Describe and apply the concept of nutrition in health and disease, micro- and macro-nutrition and essential nutrients, and interlinks of nutrients with metabolism and functions of a living system.
5. Apply and integrate knowledge of molecular and metabolic conditions in normal and disease states for clinical problem solving and research
6. Acquire knowledge on application of various aspects of genetic engineering in medicine
7. Acquire knowledge and apply the principle of statistics, biostatistics and epidemiology to the evaluation and interpretation of molecular and metabolic disease states.
8. Evaluate, analyze and monitor disease states by applying relevant biochemical investigations and interpreting the clinical and laboratory data.
9. Able to integrate principles of immunology in biochemistry.
10. Demonstrate knowledge of basics of research methodology, develop a research protocol, analyse data using currently available statistical software, interpret results and disseminate these results and to have the potential ability to pursue further specializations and eventually be competent to guide students.
11. Describe the principles of teaching - learning technology towards application and take interactive classroom lectures, prepare modules for PBL, organize and conduct PBLs, case discussions, small group discussions, Seminars, Journal club and research presentations
12. Demonstrate knowledge of principles of Instrumentation.
13. Demonstrate knowledge about recent advances and trends in research in the field of clinical biochemistry.

B. Affective domain

1. Effectively explain to patients from a variety of backgrounds, the molecular and metabolic basis of disease states and lifestyle modifications.
2. Communicate biochemical reasoning effectively with peers, staff and faculty, and other members of the health care team.
3. Demonstrate empathy and respect towards patients regardless of the biochemical nature of their disease.

4. Demonstrate respect in interactions with patients, families, peers, and other healthcare professionals.
5. Demonstrate ethical behavior and integrity in one's work.
6. Demonstrate effective use of nutrition, lifestyle and genetic counseling.
7. Be aware of the cost of diagnostic tests and economic status of patients.
8. Acquire skills for self-directed learning to keep up with developments in the field and to continuously build to improve on skills and expertise

C. Psychomotor domain

1. Able to select, justify, and interpret the results of clinical tests in biochemistry.
2. Develop differential diagnoses for molecular and metabolic causes of diseases.
3. Suggest preventive, curative, and/or palliative strategies for the management of disease.
4. Predict effectiveness and adverse effects associated with disease intervention.
5. Demonstrate skills for clinical diagnosis, testing, understanding of biochemical conditions and diagnostic service.
6. Perform important biochemical, immunological and molecular biology techniques.
7. Observed working of important advanced techniques.
8. Demonstrate standard operating procedures of various methods and techniques used in clinical biochemistry.
9. Determination of enzyme activity and study of enzyme kinetics. Ideally it should be accompanied by purification (partial) of the enzyme from a crude homogenate to emphasise the concepts of specific activity, yield and fold purification
10. Demonstrate and report routine investigations in hematology and microbiology
11. Demonstrate presentation skills at academic meetings and publications.

By the end of the course, the post graduate student should have acquired practical skills in the following:

- Performance of reactions of carbohydrates, amino acids and proteins, and lipids
- Experiments to demonstrate constituents of milk
- Experiments to demonstrate normal and abnormal constituents of urine
- Determination of iodine number and saponification number of fats
- Estimation of ammonia and amino acids by Sorenson formal titration

- Estimation of nitrogen estimation in a given amino acid solution by micro Kjeldahl method
- Estimation of phosphorus by Fiske Subbarao method
- Estimation of ascorbic acid in lime
- Estimation of calcium content in milk
- Estimation of proteins by Folin's method and dye binding method.
- Two-dimensional paper chromatography for separation of amino acids
- Preparation and estimation of starch, glycogen, cholesterol, casein (phosphorus in casein) and hemoglobin from biological samples Determination of enzyme activity and study of enzyme kinetics, using any 2 suitable enzymes (eg, catalase from rat liver and acid phosphatase from potatoes).
- Estimation of clinical analytes as detailed below:
 - blood glucose, glycated haemoglobin; performance of glucose tolerance test
 - electrolytes, arterial blood gas analysis
 - cholesterol, triglycerides, free fatty acids, phospholipids, Lp (a), urea, creatinine, uric acid, ammonia, microalbuminuria
 - parameters of liver function tests (bilirubin, hepato-biliary enzymes such as AST, ALT, ALP, GGT, serum proteins/albumin and prothrombin time)
 - Calcium, magnesium, copper (and ceruloplasmin), serum iron, TIBC and ferritin
 - markers of myocardial damage (CK, CK MB, troponins, LDH)
 - other enzymes of diagnostic relevance (eg. phosphatases, amylase etc)
 - vitamins D and B₁₂ and folate
- Electrophoresis of serum proteins
- Electrophoresis of lipoprotein (*Optional*)
- Electrophoretic separation of LDH isozymes or any other isoenzymes
- Clearance tests
- CSF analysis
- Thyroid function tests and other hormone assays by ELISA/RIA
- Preparation of buffers.

Clinical Laboratory

- Taking any one parameter, students should prepare a Levy Jennings chart and plot inter-assay and intra-assay variation for the laboratory.
- Implementation of Westgard rules.

Optional:

- Determination of reference values for any one parameter for the clinical laboratory

In addition, all efforts should be made to ensure that students at least see a demonstration of the following techniques.

- Separation of peripheral blood lymphocytes using Ficoll Hypaque
- Subcellular fractionation/marker enzymes for organelles to demonstrate fractionation
- Ultracentrifugation
- Isolation of high molecular weight DNA from tissues/blood
- Isolation of RNA; synthesis of cDNA by reverse transcription; PCR (both conventional and real-time)
- Isolation of plasmids and agarose gel electrophoresis for proteins and nucleic acids
- Basic techniques in cell culture
- High performance liquid chromatography (HPLC)

COURSES OUTCOME

SYLLABUS

The course contents are outlined below:

Paper I

Biomolecules, cell biology, biochemical techniques, biostatistics and research methodology, basics of medical education in teaching and assessment of biochemistry.

Biomolecules:

Properties of water

Concept of an acid, a base, pH, pK, buffer and buffering capacity

Classification, structure and functions of amino acids and peptides

Structural organization of proteins and relationship with their functions

- primary, secondary, tertiary and quaternary structure of proteins
- protein folding and denaturation

Structure-function relationship of proteins

- Structure and functions of hemoglobin and myoglobin
- Structure and function of collagen
- Structure and function of immunoglobulins

Classification, functions, properties and reactions of carbohydrates

Classification, properties and importance of lipids

- Fatty acids - nomenclature, classification, properties, reactions
- Mono, di- and triacylglycerols
- Trans fats
- Cholesterol - structure, properties and functions
- Phospholipids - definition, types, properties, and importance
- Glycolipids - definition, types, functions, examples.
- Lipoproteins - definition, structure, types, functions, role of apoproteins, importance in health and disease.
- Biological membranes - structure, function, properties and importance.
- Micelles and liposomes

Nucleotides and nucleic acids

- purine and pyrimidine bases in DNA and RNA
- nucleosides and nucleotides
- physiologically important nucleotides
- synthetic analogues of purine/pyrimidine bases and nucleosides used as therapeutic agents (anti-cancer drugs, anti-viral drugs)
- Watson and Crick model of DNA structure
- Structure and functions of different types of RNA.

Cell biology

- Structure of the cell and different subcellular organelles
- Structure and functions of cell membrane, solute transport across biological membranes
- Intracellular traffic and sorting of proteins

- Intracellular signaling pathways, membrane receptors and second messengers
Extracellular matrix: composition, importance and biomedical importance, cellular adhesion molecules and intercellular communication
- Cytoskeleton, muscle contraction and cell motility
- Cell cycle, mitosis, meiosis and mechanisms of cell death
- Red and white blood cells

Analytical techniques in biochemistry

- Spectrophotometry (UV and visible spectrophotometry),
- atomic absorption spectrophotometry
- Flame photometry
- Fluorometry
- Turbidimetry and nephelometry
- Gravimetry
- Electrochemistry (pH electrodes, ion-selective electrodes, gas-sensing electrodes)
- Chemiluminescence
- Water testing
- Electrophoresis (principle, types, applications; isoelectric focusing capillary electrophoresis; 2-D electrophoresis)
- Chromatography (principle, types [including high performance liquid chromatography and gas chromatography])
- Techniques in molecular biology: Blotting techniques, polymerase chain reaction (PCR), DNA and protein sequencing, microarrays and DNA chip technology, cloning techniques, genomics, proteomics and metabolomics

Nanotechnology and microfabrication

Techniques to study in vivo metabolism - NMR, SPECT, PET scans, etc

Radioisotope-based techniques and its applications

Biostatistics and research methodology

- Basic concepts of biostatistics as applied to health science

- Statistical tests: t-test, analysis of variance, chi-square test, non-parametric tests, correlation and regression
- Statistical methods of validation of diagnostic tests
- Basics of epidemiological study designs and sampling methodologies
- Meta-analysis and systematic reviews

Basics of medical education in teaching and assessment of biochemistry

Principles of adult learning, taxonomy of learning, educational objectives, principles of assessment and question paper setting, methods of assessing knowledge, appropriate use of media, microteaching, small group teaching.

Environmental Biochemistry:

Health and pollution.

Paper II:

Enzymes, bioenergetics, biological oxidation, intermediary metabolism and regulation, inborn errors of metabolism and nutrition

Enzymes:

Properties, classification, mechanism of action, coenzymes and cofactors, kinetics of enzyme activity, regulation of enzyme activity, isoenzymes, diagnostic and therapeutic enzymes, principles of assays of enzymes, enzymes as therapeutic targets of drugs.

Biological oxidation

Basic concepts of thermodynamics and its laws, as applied to living systems,

Exergonic and endergonic reactions and coupled reactions, redox potential

High energy compounds

Classification and role of oxidoreductases

Cytochromes; cytochrome P450 system

Respiratory chain and oxidative phosphorylation

- Components, complexes and functioning of the respiratory chain
- Process of oxidative phosphorylation
- Mechanisms of ATP synthesis and regulation
- Mitochondrial transport systems and shuttles
- Inhibitors, uncouplers and ionophores
- OXPHOS diseases

Overview of metabolism and intermediary metabolism

Metabolism of carbohydrates

- Digestion and absorption
- Glycolysis and TCA cycle, including regulation
- Glycogen metabolism and its regulation
- Cori cycle, gluconeogenesis and control of blood glucose
- Metabolism of fructose and galactose
- Pentose phosphate and uronic acid pathways and their significance
- Polyol pathway
- Regulation of blood glucose levels
- Diabetes mellitus (including gestational diabetes mellitus) – classification, pathogenesis, metabolic abnormalities, diagnostic criteria, principles of treatment, pathogenesis of complications, laboratory tests
- Metabolism of ethanol

Metabolism of lipids

- Digestion and absorption, including role of bile salts
- Biosynthesis and oxidation of fatty acids
- Ketone bodies – formation, utilisation and regulation
- Metabolism of unsaturated fatty acids and eicosanoids
- Metabolism of triacylglycerol; storage and mobilisation of fats
- Metabolism of cholesterol
- Metabolism of lipoproteins
- Metabolism in adipose tissue
- Role of liver in lipid metabolism
- Role of lipids in atherogenesis
- Metabolism of phospholipids and associated disorders

Metabolism of amino acids and proteins

- Digestion and absorption
- Pathways of amino acid degradation - transamination, oxidative deamination
- Transport and metabolism of ammonia
- Metabolism of individual amino acids.
- Plasma proteins

Metabolism of nucleotides

- De novo synthesis of purine nucleotides
- Salvage pathway for purines
- Degradation of purines
- De novo synthesis of pyrimidine nucleotides
- Degradation of pyrimidine
- Synthetic analogues of purine/pyrimidine bases and nucleosides used as therapeutic agents

Metabolism of haem

- Biosynthesis of heme and associated disorders
- Degradation of heme and associated disorders

Metabolism in individual tissues and in the fed and fasting states

Liver, adipose tissue, brain, RBCs

Nutrition

- Principal food components
- General nutritional requirements
- Energy requirements
- Biological value of proteins
- Thermogenic effect of food
- Balanced diet, diet formulations in health and disease, mixed diet
- Nutritional supplements
- Food toxins and additives
- Parenteral nutrition
- Disorders of nutrition, obesity, protein and protein energy malnutrition, dietary fibers, under-nutrition, laboratory diagnosis of nutritional disorders
- National Nutrition Programme.

Vitamins

Classification, biochemical role, sources, RDA and deficiency state of each vitamin (including diagnostic tests for deficiency and treatment)

Minerals

Classification, biochemical role, sources, requirement and deficiency state of each mineral (including diagnostic tests for deficiency and treatment)

Metabolism of xenobiotics

Free radicals and anti-oxidant defence systems in the body and associations with disease processes

Paper III:

Molecular biology, molecular and genetic aspects of cancer, immunology and effects of environmental pollutants on the body

Structure and organization of chromosomes and chromatin re-modelling

DNA replication

- DNA replication in prokaryotes and eukaryotes (including important differences between the two):
- Roles of DNA polymerase, helicase, primase, topoisomerase and DNA ligase
- Replication fork
- Okazaki fragments and its importance in replication.
- Overview of role of major DNA repair mechanisms – mismatch repair, base excision repair, nucleotide excision repair and double strand break repair.
- Diseases associated with abnormalities of DNA repair systems
- DNA recombination

Transcription

- Structure of a gene - exons and introns, promoter, enhancers/repressors and response elements.
- Process of transcription in prokaryotes and eukaryotes – initiation, elongation and termination (including important differences).
- Post-transcriptional processing – capping, tailing and splicing.

Genetic code and mutations

Characteristics of the genetic code

- Molecular basis of degeneracy of the genetic code (Wobble hypothesis)
- Mutagens- examples of physical, chemical and biological mutagens.
- Types of mutations – point mutations and chromosomal mutations
- Relationship of mutations with specific diseases

Translation

- Basic structure of prokaryotic and eukaryotic ribosomes.
- Structure of tRNA (diagram of clover leaf model of tRNA structure) and its function in protein synthesis.

- Function of aminoacyl tRNA synthase.
- Process of protein synthesis (translation) – initiation, elongation and termination (including important differences between prokaryotic and eukaryotic translation).
- Inhibition of prokaryotic translation by antibiotics.
- Post-translational modifications

Regulation of gene expression in prokaryotes and eukaryotes

- The operon concept in prokaryotes
- Role of general and gene specific transcription factors
- Small interference RNA (siRNA) and micro RNA (miRNA).
- Other modes of regulation of gene expression: alternative splicing, alternative promoter usage, DNA methylation, Histone acetylation / deacetylation, RNA editing, alterations of RNA stability

Recombinant DNA technology and its applications in modern medicine

- Concepts of recombinant DNA, genetic engineering, biotechnology and cloning.
- Restriction endonucleases.
- Vectors for cloning – plasmids and phages.
- Genomic and cDNA libraries.
- Applications of recombinant DNA technology in medicine.
- Gene therapy
- Diagnosis of genetic diseases and genetic counseling
- DNA fingerprinting
- DNA sequencing
- Microarrays
- Fluorescent in situ hybridization (FISH)
- DNA vaccines
- Transgenic animals
- Application of molecular techniques in forensic investigation and medico-legal cases

Overview of Human Genome Project

Basics of bioinformatics

Principles of human genetics

- Alleles, genotypes and phenotypes
- Patterns of inheritance: monogenic and polygenic inheritance
- Population genetics
- Genetic factors in causation of diseases
- Types of genetic diseases: Chromosomal, monogenic and polygenic disorders, mitochondrial disorders, nucleotide repeat expansion disorders, imprinting disorders
- Screening for genetic diseases and prenatal testing
- Ethical and legal issues related to medical genetics

Stem cells in clinical medicine

- Basic concepts regarding stem cells
- Types of stem cells: embryonic and induced pluripotent stem cells (iPSC)
- Potential applications in the clinical medicine
- Ethical and legal issues related to use of stem cells in medicine

Cancer

- Carcinogens: physical, chemical and biological
- Clonal origin of cancers

Genetic basis of carcinogenesis

- Role of oncogenes and tumour suppressor genes
- Familial cancer syndromes
- Cancer stem cells
- Epigenetic regulation in cancer
- Gene expression profiling in cancer
- Cancer cell biology: cell cycle abnormalities, telomerase activity, proliferative capacity and decreased apoptosis
- Metastasis
- Tumor markers
- Biochemical basis of cancer chemotherapy and drug resistance
- New methods of anti-cancer therapy: targeted cancer therapy, cancer immunotherapy.

Immunology

- Innate and acquired immunity
- Humoral and cell-mediated immunity
- Cells and organs of the immune system - T and B cells, macrophages, dendritic cells, NK cells, granulocytes
- Antigens, epitopes and haptens
- Immunoglobulin classes, isotypes, allotypes, idiotypes, monoclonal antibodies, organization and expression of immunoglobulin genes, immunoglobulin gene rearrangement, class switching
- Antigen-antibody interaction - immunochemical techniques
- Major histocompatibility complex, antigen processing and presentation,
- T cell and B cell receptor, toll like receptors
- T cell maturation/activation/differentiation
- B cell generation/activation/differentiation
- Cytokines
- Complement system, cell
- Immune response to infections
- Hypersensitivity reactions
- Vaccines
- Immuno-deficiency syndromes

- Autoimmunity
- Transplantation immunology
- Cancer and immune system,
- Immunodiagnostics
- Immunotherapy

Paper IV

Clinical biochemistry and molecular diagnostics related to different body systems/organs, endocrinology, and recent advances in biochemistry

Basic principles and practice of clinical biochemistry

Units of measure, reagents, clinical laboratory supplies, basic separation techniques, laboratory calculations, specimen collection and processing, safety in the laboratory, clinical utility of laboratory tests (including sensitivity, specificity, ROC curves, etc), analysis in the laboratory, selection and evaluation of methods (including statistical techniques), evidence-

based laboratory medicine, establishment and use of reference values, pre-analytical variables and biological variations, quality management, clinical laboratory informatics

Analytical techniques and instrumentation

Principles of basic techniques used in a clinical biochemistry laboratory (spectrophotometry, electrochemistry, electrophoresis, osmometry, chromatography, mass spectrometry, immunochemical techniques, molecular techniques, automation, point of care testing,

Clinical correlates and analytical procedures

- Amino acids, peptides and proteins; non-protein nitrogenous compounds
- enzymes
- carbohydrates
- lipids, lipoproteins and apolipoproteins and other cardiovascular risk factors
- electrolytes
- blood gases and pH
- hormones and associated disorders
- catecholamines and serotonin
- vitamins; trace and toxic elements
- hemoglobin, and bilirubin

- porphyrins and associated disorders
- bone and mineral metabolism
- tumour markers
- assessment of organ functions (hypothalamus and pituitary, adrenal glands, gonads, thyroid, parathyroid, liver, kidney, heart, stomach, pancreas, intestine, etc) and associated disorders
- pregnancy and maternal and fetal health
- reproduction related disorders – infertility
- newborn screening
- inborn errors of metabolism
- hemostasis
- therapeutic drug monitoring
- clinical toxicology
- molecular diagnostics
- body fluid analyses

Regulation of fluid and electrolyte balance and associated disorders

Regulation of acid-base balance and associated disorders

Biochemistry of the endocrine system

- Classification and general mechanism of action of hormones
- Biosynthesis, secretion, regulation, transport and mode of action of hypothalamic peptides, adenohipophyseal and neurohipophyseal hormones, thyroid and parathyroid hormones, calcitonin, pancreatic hormones, adrenocortical and medullary hormones, gonadal hormones, gastrointestinal hormones, opioid peptides, parahormones.
- Biochemistry of conception, reproduction and contraception
- Endocrine interrelationship and their involvement in metabolic regulation
- Neuro-modulators and their mechanism of action and physiological significance
- Biochemical aspects of diagnosis and treatment of endocrinal disorders:

Hematopoietic disorders

Iron deficiency and other hypoproliferative anaemias - iron metabolism, laboratory

tests of iron status, iron therapy

- Anaemia of chronic disease, anaemia of renal disease
- Hemoglobinopathies - sickle cell anaemia, methaemoglobinemias, thalassemia syndromes, Megaloblastic anaemia
- RBC membrane and metabolism
- Hemolytic anaemia - inherited defects in RBC membrane and enzymes (G6PD deficiency), immunologic causes of hemolysis
- ABO blood group system - biochemical basis, transfusion biology.
- Plasma cell disorders - multiple myeloma.

Hemostasis and thrombosis

Biochemical mechanisms, related laboratory tests, antiplatelet/anticoagulant/fibrinolytic therapy

Cardiovascular system

Atherosclerosis - pathogenesis, risk factors, prevention and treatment

Cardiac failure, acute coronary syndrome, cardiac biomarkers

Respiratory system

Gaseous exchange in lungs - physiological features and disturbances, arterial blood gases

Pathogenesis of cystic emphysema, alpha-1 anti-trypsin deficiency

Kidney

Kidney function tests; pathophysiology, biochemistry, laboratory findings and management in acute kidney injury and chronic kidney disease; estimation of GFR; glomerular diseases - pathogenesis and mechanisms of glomerular injury, nephrotic syndrome, diabetic nephropathy; tubular disorders - renal tubular acidosis, proteinuria, nephrolithiasis, kidney transplant; biochemical aspects of renal stones.

Gastrointestinal system

- Gastric physiology
- Pathophysiology of peptic ulcer disease, including role of *H. pylori*; gastric function tests; Zollinger-Ellison syndrome
- Digestion and absorption of nutrients; evaluation of malabsorption (steatorrhea, lactose intolerance)

- Celiac disease
- Inflammatory bowel disease
- Protein losing enteropathy
- Regulatory peptides in the gut
- Neuroendocrine tumours

Liver

- Liver function tests
- Hyperbilirubinemias
- Viral hepatitis
- Serologic/virologic markers
- Alcoholic liver disease, fatty liver, chronic liver disease, cirrhosis and its complications
- Pathogenesis of ascites
- Hepatic encephalopathy
- Metabolic diseases affecting liver
- Reye's syndrome
- Diseases of gall bladder/bile ducts - pathogenesis of gallstones
- Pancreas - acute and chronic pancreatitis, cystic fibrosis, pancreatic function tests.

Bone and mineral metabolism

Bone structure and metabolism; metabolism of calcium, phosphate and magnesium; regulation and abnormalities of bone metabolism; vitamin D; parathyroid hormone; calcitonin; parathyroid hormone-related (PTHrP); osteoporosis – pathophysiology; markers of bone turnover

Nervous system

- Neurotransmitters and their receptors
 - Ion channels and channelopathies
 - Neurotrophic factors
 - Protein aggregation and neurodegeneration
-
- Alzheimer's disease, Parkinson's disease, Huntington's disease, multiple sclerosis
 - Prions and prion diseases
 - Guillain-Barre syndrome – immunopathogenesis

- Myasthenia gravis – pathophysiology
- Hereditary myopathies - Duchenne muscular dystrophy
- Inherited disorders of muscle energy metabolism
- Mitochondrial myopathies
- Pathophysiology of psychiatric disorders such as anxiety, depression and schizophrenia

MD-MICROBIOLOGY

Program Outcomes:

A post graduate student upon successfully qualifying in the MD (Microbiology) examination should be able to:

- PO1. Demonstrate competence as a clinical microbiologist
- PO2. Interact effectively with the allied departments by rendering services in basic as well as advanced laboratory investigations
- PO3. Demonstrate application of microbiology in a variety of clinical settings to solve diagnostic and therapeutic problems along with preventive measures.
- PO4. Play a pivotal role in hospital infection control, including formulation of antibiotic policy and management of biomedical waste.
- PO5. Acquire skills in conducting collaborative research in the field of Microbiology and allied sciences.
- PO6. Conduct such clinical/experimental research as would have significant bearing on human health and patient care
- PO7. Demonstrate effective communication skills required for the practice of clinical microbiology and while teaching undergraduate students
- PO8. Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology.
- PO9. Plan, execute and evaluate teaching assignments in Medical Microbiology.
- PO10. Plan, execute, analyse and present the research work in medical microbiology.

PO11. To acquire various skills for collaborative research.

PO12. To participate in various workshops/seminars/journal clubs/demonstration in the allied departments

PO13. Uphold the prestige of the discipline amongst the fraternity of doctors.

SUBJECT SPECIFIC COMPETENCIES

A) Cognitive Domain:

At the end of the course, the student should have acquired knowledge in the following theoretical competencies:

General Microbiology

1. Important historical events and developments in microbiology
2. Basic as well as advanced knowledge in various microscopes and microscopic techniques used in diagnostic microbiology
3. Various bio-safety issues including physical and biological containment, universal containment, personal protective equipment for biological agents
4. Various isolation precautions including standard and transmission based precautions
5. In-depth knowledge about various methods of Sterilization, disinfection and lyophilization
6. Nomenclature, classification and morphology of bacteria as well as other microorganisms
7. Various types and significance of normal flora of human body in health and disease states.
8. Requirements for growth and nutrition of bacteria along with bacterial metabolism
9. Various types and role of bacterial toxins and bacteriocins
10. Microbiology of air, milk, water as well as hospital environment
11. Various types of host-parasite relationship and their significance
12. Various antimicrobial agents and mechanisms drug resistance
13. Bacterial genetics, bacteriophages and molecular genetics relevant for medical

microbiology

14. Applications of quality assurance, quality control in microbiology and accreditation of laboratories

Immunology

1. Components of immune system, types of immunity (Innate, acquired, mucosal, humoral and cell mediated immunity) and immune response
2. Describes and identifies uses of various antigens, immunoglobulins (antibodies) and antigen and antibody reactions
3. Complement system and Cytokines
4. Various disorders like hypersensitivity, immunodeficiency and auto-immunity involving immune system
5. MHC complex, Immune tolerance, Transplantation and Tumor immunity
6. Various types, techniques, advances, and applications of vaccines and immunotherapy
7. Measurement of immunological parameters
8. Immunological techniques and their applications in diagnostic microbiology as well as research
9. Mechanisms and significance of immune-potential and immune-modulation

Systemic bacteriology

1. Demonstrate knowledge and skills in various techniques for isolation and identification of bacteria
2. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis treatment and prevention of major bacterial pathogens of medical importance given below-
 - a. Gram positive cocci including *Staphylococcus*, *Micrococcus*, *Streptococcus*, anaerobic cocci etc.
 - b. Gram negative cocci including *Neisseria*, *Branhamella*, *Moraxella* etc.

- c. Gram positive bacilli including *Lactobacillus*, *Coryneform* bacteria, *Bacillus* and aerobic bacilli, *Actinomyces*, *Nocardia*, *Actinobacillus* and other actinomycetales, *Erysipelothrix*, *Listeria*, *Clostridium* and other spore bearing anaerobic bacilli etc.
- d. Gram negative bacilli including *Vibrios*, *Aeromonas*, *Plesiomonas*, *Haemophilus*, *Bordetella*, *Brucella*, *Gardnerella*, *Pseudomonas* and other non-fermenters, *Pasteurella*, *Francisella*, *Bacteroides*, *Fusobacterium*, *Leptotrichia* and other anaerobic gram negative bacilli etc.
- e. *Helicobacter*, *Campylobacter*, *Calymmatobacterium*, *Streptobacillus*, *Spirillum* and miscellaneous bacteria
- f. *Enterobacteriaceae*
- g. *Mycobacteria*
- h. *Spirochaetes*
- i. *Chlamydia*
- j. *Mycoplasmatales*; *Mycoplasma*, *Ureaplasma*, *Acholeplasma* and other *Mycoplasmas*.
- k. *Rickettsiae*, *Coxiella*, *Bartonella* etc.

Mycology

1. Explain general characteristics including morphology, reproduction and classification of fungi
2. Demonstrate knowledge and skills for isolation and identification of fungi
3. Explain tissue reactions to fungi
4. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis treatment and prevention of major fungal pathogens of medical importance given below-
 - a. Yeasts and yeast like fungi including *Candida*, *Cryptococcus*, *Malassezia*, *Trichosporon*, *Geotrichum*, *Saccharomyces* etc.
 - b. Mycelial fungi including *Aspergillus*, *Zygomycetes*, *Pseudallescheria*,

Fusarium, *Piedra*, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.

- c. Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium marneffeii* etc.
- d. Dermatophytes
- e. Fungi causing Mycetoma, Chromoblatomycosis, Occulomycosis and Otomycosis.
- f. *Pneumocystis jirovecii* infection
- g. *Rhinosporidium seeberi* and *Lacazia loboi* (formerly named *Loboa loboi*)
- h. *Pythium insidiosum*
- i. *Prototheca*

- 5. Able to identify laboratory contaminant fungi
- 6. Explain Mycetism and mycotoxicosis along with agents involved
- 7. Demonstrates knowledge about antifungal agents and perform *in vitro* antifungal susceptibility tests.

Virology

- 1. Demonstrates knowledge about general properties, classification, morphology, virus replication and genetics of viruses
- 2. Explain pathogenesis of viral infections
- 3. Demonstrates knowledge about isolation and identification of viruses
- 4. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major DNA viruses of medical importance including *Pox viruses*, *Herpes viruses*, *Adeno viruses*, *Hepadna virus*, *Papova viruses* and *Parvo viruses* etc.
- 5. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and

prevention of major RNA viruses of medical importance including *Enteroviruses*, *Toga viruses*, *Flavi viruses*, *Orthomyxo viruses*, *Paramyxo viruses*, *Reo viruses*, *Rhabdo viruses*, *Arena viruses*, *Bunya viruses*, *Retro viruses*, *Filo viruses*, *Human Immunodeficiency Virus*, *Arbo viruses*, *Corona viruses*, *Calci viruses* etc.

6. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major *Hepatitis viruses*
7. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of unclassified viruses and slow viruses including prions
8. Demonstrate knowledge about viral vaccines and anti-viral drugs.

Parasitology

1. Demonstrate knowledge about general characters, classification and methods of identification of parasites.
2. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of Protozoan parasites of medical importance including *Entamoeba*, *Free living amoebae*, *Giardia*, *Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma*, *Sarcocystis*, *Cryptosporidium*, *Microsporidium*, *Cyclospora* *Isospora*, *Babesia*, *Balantidium*, etc.
3. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of helminthes of medical importance including those belonging to Cestoda (*Diphyllobothrium*, *Taenia*, *Echinococcus*, *Hymenolepis*, *Dipylidium*, *Multiceps* etc.), Trematoda (*Schistosomes*, *Fasciola*, *Fasciolopsis*, *Gastrodiscoides*, *Paragonimus*, *Clonorchis*, *Opisthorchis* etc.) and Nematoda (*Trichiuris*, *Trichinella*, *Strongyloides*, *Ancylostoma*, *Necator*, *Ascaris*, *Toxocara*, *Enterobius*, *Filarial worms*, *Dracunculus* etc.)

4. Demonstrate knowledge about common arthropods and other vectors viz. mosquito, sand fly, ticks, mite, cyclops, louse, myasis of medical importance.
5. Demonstrate knowledge about anti-parasitic vaccine and drugs.

Applied Microbiology

1. Demonstrate knowledge about epidemiology of infectious diseases
2. Demonstrate knowledge about antimicrobial prophylaxis and therapy
3. Demonstrate knowledge about hospital acquired infections
4. Demonstrate knowledge about management of biomedical waste
5. Effectively investigate an infectious outbreak in hospital and community
6. Demonstrate knowledge about infections of various organs and systems of human body viz. respiratory tract infections, urinary tract infections, central nervous system infections, congenital infections, reproductive tract infections, gastrointestinal infections, hepatitis, pyrexia of unknown origin, infections of eye, ear and nose, septicaemia, endocarditis, haemorrhagic fever etc.
7. Demonstrate knowledge about opportunistic infections
8. Demonstrate knowledge about various sexually transmitted diseases
9. Demonstrate knowledge about principles, methods of preparation, administration and types of vaccines
10. Effectively use information technology (Computers) in microbiology
11. Demonstrate knowledge and applications of Automation in Microbiology
12. Demonstrate knowledge and applications about molecular techniques in the laboratory diagnosis of infectious diseases
13. Demonstrate knowledge in statistical analysis of microbiological data and research methodology
14. Demonstrate knowledge in animal and human ethics involved in microbiology
15. Demonstrate knowledge in safety in laboratory and Laboratory management

B) Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of

- cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopts ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
 3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and students for effective teaching.

C) Psychomotor domain:

1. Collection/transportation of specimens for microbiological investigations
2. Preparation, examination and interpretation of direct smears from clinical specimens
3. Plating of clinical specimens on media for isolation, purification, identification and quantification purposes.
4. Preparation of stains viz. Gram, Albert's, Ziehl Neelsen (ZN), Silver impregnation stain and special stains for capsule and spore etc.
5. Preparation and pouring of media like Nutrient agar, Blood Agar, Mac-Conkey agar, Sugars, Kligler iron agar/Triple sugar iron agar (TSI), Robertson's cooked meat broth, Lowenstein Jensens medium, Sabouraud's dextrose agar etc.
6. Preparation of reagents-oxidase, Kovac etc.
7. Quality control of media, reagents etc.
8. Operation of autoclave, hot air oven, filters like Seitz and membrane filters etc
9. Care and operation of microscopes
10. Washing and sterilization of glassware (including plugging and packing)
11. Care, maintenance and use of common laboratory equipments like autoclave, hot air oven, water bath, centrifuge, refrigerators, incubators etc.
12. Aseptic practices in laboratory and safety precautions. Selection of Personal Protective Equipment according to task and donning (gloves, mask, eye protection, gown etc).

13. Sterility tests
14. Identification of bacteria of medical importance up to species level (except anaerobes which could be up to generic level).
15. Techniques of anaerobiosis
16. Tests for Motility: hanging drop, Cragie's tube, dark ground microscopy for *spirochaetes*
17. Routine and Special tests - Catalase test, Oxidase test, slide and tube coagulase tests, niacin and catalase tests for *Mycobacterium*, bile solubility, chick cell agglutination, sheep cell haemolysis, satellitism, CAMP test, and other biochemical tests.
18. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing eg. Kirby-Bauer, Stoke's method, Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/plate dilution methods.
19. Tests for β -lactamase production.
20. Screening of gram negative isolates for ESBL and MBL
21. Screening of *Staphylococci* for Methicillin Resistance.
22. Screening of *Enterococci* for Vancomycin resistance.
23. Testing of disinfectants.
24. Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteriuria
25. Disposal of contaminated materials like cultures
26. Disposal of infectious waste
27. Bacteriological tests for water, air and milk
28. Maintenance and preservation of bacterial cultures

COURSE OUTCOME

Syllabus

Paper I: General Microbiology

1. History of microbiology

2. Microscopy
3. Bio-safety including universal containment, personal protective equipment for biological agents
4. Physical and biological containment
5. Isolation precautions including standard precautions and transmission based precautions
6. Sterilization, disinfection and lyophilization
7. Morphology of bacteria and other microorganisms
8. Nomenclature and classification of microorganisms
9. Normal flora of human body
10. Growth and nutrition of bacteria
11. Bacterial metabolism
12. Bacterial toxins
13. Bacteriocins
14. Microbiology of hospital environment
15. Microbiology of air, milk and water
16. Host-parasite relationship
17. Antimicrobial agents and mechanisms drug resistance
18. Bacterial genetics and bacteriophages
19. Molecular genetics relevant for medical microbiology
20. Quality assurance and quality control in microbiology
21. Accreditation of laboratories

Immunology

1. Components of immune system
2. Innate and acquired immunity
3. Cells involved in immune response
4. Antigens
5. Immunoglobulins
6. Mucosal immunity

7. Complement
8. Antigen and antibody reactions
9. Hypersensitivity
10. Cell mediated immunity
11. Cytokines
12. Immunodeficiency
13. Auto-immunity
14. Immune tolerance
15. MHC complex
16. Transplantation immunity
17. Tumor immunity
18. Vaccines and immunotherapy
19. Measurement of immunological parameters
20. Immunological techniques
21. Immunopotential and immunomodulation

Paper II: Systematic bacteriology

1. Isolation and identification of bacteria
2. Gram positive cocci of medical importance including *Staphylococcus*, *Micrococcus*, *Streptococcus*, *anaerobic cocci* etc.
3. Gram negative cocci of medical importance including *Neisseria*, *Branhamella*, *Moraxella* etc.
4. Gram positive bacilli of medical importance including *Lactobacillus*, *Coryneform organisms*, *Bacillus* and *aerobic bacilli*, *Actinomyces*, *Nocardia*, *Actinobacillus* and other *actinomycetales*, *Erysipelothrix*, *Listeria*, *Clostridium* and other spore bearing anaerobic bacilli etc.
5. Gram negative bacilli of medical importance including *Vibrios*, *Aeromonas*, *Plesiomonas*, *Haemophilus*, *Bordetella*, *Brucella*, *Gardnerella*, *Pseudomonas* and other *non-fermenters*, *Pasteurella*, *Francisella*, *Bacteroides*, *Fusobacterium*, *Leptotrichia* and other anaerobic gram negative bacilli etc.

6. *Helicobacter, Campylobacter, Calymmatobacterium, Streptobacillus, Spirillum* and miscellaneous bacteria
7. *Enterobacteriaceae*
8. *Mycobacteria*
9. *Spirochaetes*
10. *Chlamydia*
11. *Mycoplasmatales; Mycoplasma, Ureaplasma, Acholeplasma and other Mycoplasmas.*
12. *Rickettsiae, Coxiella, Bartonella etc.*

Mycology

1. General characteristics and classification of fungi
2. Morphology and reproduction of fungi
3. Isolation and identification of fungi
4. Tissue reactions to fungi
5. Yeasts and yeast like fungi of medical importance including *Candida, Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces* etc.
6. Mycelial fungi of medical importance including *Aspergillus, Zygomycetes, Pseudallescheria, Fusarium, Piedra, other dematiaceous hyphomycetes and other hyalohyphomycetes* etc.
7. Dimorphic fungi including *Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Penicillium marneffeii* etc.
8. *Dermatophytes*
9. Fungi causing Mycetoma, Chromoblatomycosis, Occulomycosis and Otomycosis.
10. *Pythium insidiosum*
11. *Prototheca*
12. *Pneumocystis jirovecii infection*
13. *Rhinosporidium seeberi and Lacazia loboi (Loboa loboi)*
14. Laboratory contaminant fungi
15. Mycetism and mycotoxicosis
16. Antifungal agents and *in vitro* antifungal susceptibility tests.

Paper III: Virology

1. General properties of viruses
2. Classification of viruses
3. Morphology: Virus structure
4. Virus replication
5. Isolation and identification of viruses
6. Pathogenesis of viral infections
7. Genetics of viruses
8. DNA viruses of medical importance including Pox viruses, Herpes viruses, Adeno viruses, Hepadna virus, Papova and Parvo viruses etc.
9. RNA viruses of medical importance including Enteroviruses, Toga viruses, Flavi viruses, Orthomyxo viruses, Paramyxo viruses, Reo viruses, Rhabdo viruses, Arena viruses, Bunya viruses, Retro viruses, Filo viruses, Human immunodeficiency virus, Arbo viruses, Corona viruses, Calci viruses etc.
10. Slow viruses including prions
11. Unclassified viruses
12. Hepatitis viruses
13. Virioids, prions
14. Vaccines and anti-viral drugs.

Parasitology

1. General characters and classification of parasites.
2. Methods of identification of parasites
3. Protozoan parasites of medical importance including *Entamoeba*, *Free living amoebae*, *Giardia*, *Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma*, *Sarcocystis*, *Cryptosporidium*, *Microsporidium*, *Cyclospora*, *Isospora*, *Babesia*, *Balantidium*, etc.
4. Helminthology of medical importance including those belonging to Cestoda (*Diphyllobothrium*, *Taenia*, *Echinococcus*, *Hymenolepis*, *Dipylidium*, *Multiceps*

etc.), Trematoda (*Schistosomes, Fasciola, Fasciolopsis, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis* etc.) and Nematoda (etc.)

5. Entomology: common arthropods and other vectors viz. mosquito, sand fly, ticks, mite, cyclops, louse, myasis.
6. Anti-parasitic agents.

Paper IV: Applied Microbiology

1. Epidemiology of infectious diseases
2. Antimicrobial prophylaxis and therapy
3. Hospital acquired infections
4. Management of biomedical waste
5. Investigation of an infectious outbreak in hospital and community
6. Infections of various organs and systems of human body viz. respiratory tract infections, urinary tract infections, central nervous system infections, congenital infections, reproductive tract infections, gastrointestinal infections, hepatitis, pyrexia of unknown origin, infections of eye, ear and nose, septicaemia, endocarditis, haemorrhagic fever etc.
7. Opportunistic infections
8. Sexually transmitted diseases
9. Vaccinology: principles, methods of preparation, administration of vaccines, types of vaccines
10. Information technology (Computers) in microbiology
11. Automation in Microbiology
12. Molecular techniques in the laboratory diagnosis of infectious diseases
13. Statistical analysis of microbiological data and research methodology
14. Animal and human ethics involved in microbiological work.
15. Safety in laboratory and Laboratory management

MD-PHARMACOLOGY

Program Outcomes:

At the end of the MD training programme in Pharmacology, the student should acquire competencies in the following areas:

CO1. Acquisition of knowledge: The student should be able to explain clearly concepts and principles of Pharmacology and therapeutics. The student should also be able to explain the drug development processes. She/he should be able to explain Drugs and Cosmetics Act, in addition to clinical trial procedures.

CO2. Teaching and training: The student should be able to effectively teach undergraduate students in medicine (MBBS) and allied health science courses (Dentistry and Nursing) so they become competent healthcare professionals and able to contribute to training of postgraduate trainees.

CO3. Research: The student should be able to carry out a research project (both basic and clinical) from planning to publication and be able to pursue academic interests and continue life-long learning to become more experienced in all the above areas and to eventually be able to guide postgraduates in their thesis work.

SUBJECT SPECIFIC COMPETENCIES

The student during the training program should acquire the following competencies:

A. Cognitive domain

1. Describe and apply pharmacological principles to explain the mechanism/s of the effects of drugs used in diagnosis, prevention and treatment of diseases of all systems of human body.
2. Explain pharmacodynamics and pharmacokinetics of drugs.
3. Describe mechanisms of drug-drug interactions and their clinical importance.
4. Apply and integrate knowledge of pathophysiology of diseases and its modulation by drugs.
5. Acquire knowledge on pharmacogenetics and pharmacogenomics
6. Acquire knowledge on principles of pharmacoconomics
7. Acquire knowledge on pharmacoepidemiology, including drug utilization studies.
8. Acquire knowledge and understanding of principles of Good clinical practice (GCP) and Good laboratory practice (GLP) guidelines

9. Acquire knowledge on essential medicines
10. Acquire knowledge on pharmacovigilance
11. Acquire knowledge and apply the principle of biostatistics in the evaluation and interpretation of drug safety and efficacy studies
12. Describe how to evaluate, analyse and monitor preclinical and clinical data in drug discovery
13. Able to integrate principles of immunology in biochemistry.
14. Demonstrate knowledge of basics of research methodology, develop a research protocol, conduct the study, record experimental observations, analyse data using currently available statistical software, interpret results and disseminate these results and to have the potential ability to pursue further specializations and eventually be competent to guide students.
15. Describe the principles of teaching - learning technology towards application and take interactive classroom lectures, modules for problem based learning (PBL), case discussions, small group discussions, seminars, Journal club and research presentations
16. Demonstrate knowledge about computer assisted learning (CAL) softwares and ability to use them efficiently to promote learning of pharmacology.
17. Demonstrate knowledge of principles of Instrumentation.
18. Demonstrate knowledge about recent advances and trends in research in the field of pharmacology and clinical pharmacology.
19. Acquire knowledge on generic drugs and generic prescription.
20. Acquire knowledge on rational use of drugs and prescription auditing
21. Acquire knowledge about antimicrobial stewardship programs and strategies for containment of antibiotic resistance
22. Acquire knowledge on animal toxicity studies
23. Acquire knowledge on common poisoning
24. Acquire knowledge on the legal and ethical issues involved in drug development and research.
25. Acquire knowledge in Biostatistics including use of statistical softwares :
 - Estimation Sample size for a clinical trial
 - Scales of measurement, data display, measures of central tendency (mean, median, mode)
 - Dispersion of data (variance, standard deviation)
 - Selection of tests (of significance) and their applicability
 - Correlation and regression analysis
 - Basics of systematic reviews and meta-analysis

B. Affective domain

1. Effectively explain to patients, the effects and side effects of drugs, including the need for medication adherence.
2. Communicate effectively with pharmacological reasoning with students, peers, staff and faculty, and other members of the health care team on rational use of drugs and improving spontaneous reporting of adverse events.
3. Demonstrate respect in interactions with peers, and other healthcare professionals.

4. Demonstrate ethical behavior and integrity in one's work.
5. Demonstrate ability to generate awareness about the use of generic drugs in patients.
6. Acquire skills for self-directed learning to keep up with developments in the field and to continuously build to improve on skills, expertise and perpetual professional development.

C. Psychomotor domain

1. Able to predict efficacy and adverse effects associated with use of drugs, along with causality assessment.
2. Demonstrate skills for prescription writing.
3. Perform major *in vivo* and *in vitro* animal experiments.
4. Observe and understand basic principles of working of important advanced techniques, like High Performance Liquid Chromatography (HPLC).
5. Demonstrate standard operating procedures of various methods and techniques used in clinical trials and research.
6. Determine levels of common poisons in blood
7. Demonstrate presentation skills at academic meetings, publications and writing research projects for funding agencies.
8. Be able to analyze and evaluate a research paper

By the end of the course, the trainee should have acquired practical skills in the following:

1. *In vivo* and *ex vivo* experiments, like organ bath, analgesiometer, physiography/polygraph, convulsiometer, plethysmograph, learning and memory, models for affective disorders.
2. Administration of drugs by various routes (subcutaneous, intravenous, intraperitoneal) in experimental animals
3. Collection of blood samples and oral gavage in experimental animals
4. Preparation and administration of a drug solution in appropriate strength and volume
5. Experiments to show dose response curve of agonists (in the presence or absence of an antagonist) on various biological tissues, like
 - i) Isolated rabbit/rat/ guinea-pig intestine
 - ii) Isolated rat uterus
6. Determination of EC₅₀, ED₅₀, pD₂ and pA₂ values of drugs
7. Perform *in vivo* experiments to study effect of mydiatrics and miotics on rabbit eye
8. Perform *in vivo* experiments to study effect of antiepileptic drugs using animal models of epilepsy

9. Perform *in vivo* experiments to study effect of analgesics using animal models of analgesia
10. Perform *in vivo* experiments to study effects of drugs on learning, memory and motor coordination
11. Estimate toxic drug levels using chemical and biological tests (alkaloids, glycosides, steroids, barbiturates, salicylates) by commonly used methods)
12. Clinical pharmacology
 - i) Prepare protocol for a clinical trial
 - ii) Prepare Informed consent form and participant information sheet for research involving human participants
 - iii) Report Serious Adverse Effect (SAE)
 - iv) Evaluate promotional drug literature
 - v) Prepare “Drug Information Sheet” (WHO criteria)
 - vi) Interpret bioavailability parameters with the help of given pharmacokinetics data
 - vii) Perform causality assessment and report ADR as per Pharmacovigilance Programme of India (PvPI)

Animal Experiments: All animal experiments must be compliant with Govt. of India regulations, notified from time to time. Amphibian/Dog/Cat experiments should be conducted by computer assisted simulation models/ facilities. Other experiments should be performed as permissible by CPCSEA guidelines

COURSES OUTCOME

Syllabus

The **course contents** should cover the following broad topics:

1. Basic and molecular pharmacology
2. Drug receptors and Pharmacodynamics
3. Pharmacokinetics (Absorption, Distribution, Metabolism and Excretion)
4. Biotransformation
5. Pharmacogenomics and Pharmacogenetics
6. Autonomic Pharmacology
7. Drugs acting on Smooth muscles
8. Clinical pharmacology
9. Drug development and Regulations
10. Clinical Pharmacokinetics
11. Drugs acting on Synaptic and Neuroeffector Junctional sites
12. Drugs acting on Central Nervous System (Sedative, Hypnotics, Antiepileptics, General Anesthetics, Local Anesthetics, Skeletal Muscle Relaxants,

- Antipsychotic, Antidepressants, Drugs used in Parkinson's disease and other neurodegenerative disorders, opioid agonists and antagonists, Drugs of abuse)
13. Drugs modifying renal function
 14. Drugs acting on cardiovascular system and haemostatic mechanisms
(Antihypertensives, Antianginal, Antiarrhythmics, Drugs used in heart failure, Drugs used in Dyslipidemias, Fibrinolytics, Anticoagulants, Antiplatelets)
 15. Reproductive Pharmacology
 16. Agents effecting calcification and bone turnover
 17. Autacoids and related pharmacological agents (NSAIDs) and drugs used in Rheumatoid arthritis and Gout
 18. Gastrointestinal drugs
 19. Pharmacology of drugs affecting the respiratory system (drugs used in Bronchial Asthma and COPD)
 20. Antimicrobial, antiparasitics, disinfectants, antiseptics
 21. Chemotherapy of neoplastic disease
 22. Antiviral drugs
 23. Drugs used in Autoimmune disorder and Graft versus Host Disease)
 24. Dermatological pharmacology
 25. Ocular pharmacology
 26. Use of drugs in pregnancy
 27. Perinatal and Pediatric Pharmacology
 28. Geriatric Pharmacology
 29. Immunomodulators - immunosuppressants and immunostimulants
 30. Pharmacology of drugs used in endocrine disorders (drugs used in diabetes mellitus, hypothalamic and pituitary hormones, thyroid and antithyroid drugs, adrenocorticoid hormones and their antagonists, gonadal hormones and their inhibitors)
 31. Drug delivery systems
 32. Heavy metal poisoning
 33. Non-metallic toxicants - air pollutants, pesticides etc.
 34. Research methodology and biostatistics
 35. Literature search.
 36. Pharmacogenomics, Pharmacovigilance (ADR reporting), pharmacoeconomics (cost-effectiveness study) and pharmacoepidemiology
 37. Over the counter drugs
 38. Dietary supplements and herbal medicines
 39. Pharmacometrics - methods of drug evaluation.
 40. General screening and evaluation of:
 - Analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs, antidepressants, antianxiety and antipsychotics, sedatives, muscle

relaxants, antihypertensives, hypocholesterolaemic agents, anti-arrhythmics, diuretics, adrenergic blocking drugs

- Drugs used in peptic ulcer diseases/Prokinetic agents/ antiemetics
- Antitussives, /anti-asthma agents
- Local Anaesthetics
- Oxytocics, antifertility agents
- Antidiabetics

Behavioral pharmacology models and evaluation of drugs affecting learning and memory

41. Bioassays

- Bioassay methods
- Animal experiments: Ethical considerations, ethical approval, applicable regulatory Guidelines (CPCSEA), humane animal research (principles of 3Rs) and alternatives to animal experimentation. General and statistical considerations
- Anesthetics used in laboratory animals
- Principles of EC₅₀, ED₅₀, pD₂ and pA₂ values of drugs
- Describe methods of bioassay for estimation of :
Acetylcholine, skeletal neuromuscular junction blockers, adrenaline, noradrenaline, histamine, 5 HT, hormones, insulin, vasopressin/oxytocin, estrogen, progestins, ACTH
- Competitive antagonism - pA₂ values
- Immunoassays: Concept, types of bioassays and their application/s
- Animal experiments: Ethical consideration, ethical approval
- Regulatory Guidelines (CPCSEA) and alternatives to animal experimentation

42. **Biochemical Pharmacology**

- Basic principles and applications of simple analytical methods

- Principles of quantitative estimation of drugs, endogenous compounds and poisons using Colorimetry, Spectrophotometry, flame photometry, High Performance Liquid Chromatography (HPLC) and enzyme-linked immunosorbent assay (ELISA).

MD-PATHOLOGY

Program Outcomes:

PO1. Diagnose routine and complex clinical problems on the basis of histopathology (surgical pathology) and cytopathology specimens, blood and bone marrow examination and various tests of Laboratory Medicine (clinical pathology, clinical biochemistry) as well as Blood Banking (Transfusion Medicine).

PO2. Interpret and correlate clinical and laboratory data so that clinical manifestations of diseases can be explained.

PO3. Advise on the appropriate specimens and tests necessary to arrive at a diagnosis in a problematic case.

PO4. Correlate clinical and laboratory findings with pathology findings at autopsy, identify miscorrelations and the causes of death due to diseases (apart from purely metabolic causes).

PO5. Should be able to teach Pathology to undergraduates, postgraduates, nurses and paramedical staff including laboratory personnel.

PO6. Plan, execute, analyse and present research work.

PO7. Make and record observations systematically and maintain accurate records of tests and their results for reasonable periods of time. Identify problems in the laboratory, offer solutions thereof and maintain a high order of quality control.

PO8. Capable of safe and effective disposal of laboratory waste.

PO9. Able to supervise and work with subordinates and colleagues in a laboratory.

SUBJECT SPEIFIC COMPETENCIES

A. Cognitive domain

A post graduate student upon successfully qualifying in the MD (Pathology) examination should have acquired the following broad theoretical competencies and should be:

1. Capable of offering a high quality diagnostic opinion in a given clinical situation with an appropriate and relevant sample of tissue, blood, body fluid, etc. for the purpose of diagnosis and overall wellbeing of the ill.
2. Able to teach and share his knowledge and competence with others. The student should be imparted training in teaching methods in the subject which may enable the student to take up teaching assignments in Medical Colleges/Institutes.
3. Capable of pursuing clinical and laboratory based research. He/she should be introduced to basic research methodology so that he/she can conduct fundamental and applied research.

B. Affective domain

1. The student will show integrity, accountability, respect, compassion and dedicated patient care. The student will demonstrate a commitment to excellence and continuous professional development.
2. The student should demonstrate a commitment to ethical principles relating to providing patient care, confidentiality of patient information and informed consent.
3. The student should show sensitivity and responsiveness to patients' culture, age, gender and disabilities.

C. Psychomotor domain

At the end of the course, the student should have acquired skills, as described below:

Surgical pathology

Skills

- Given the clinical and operative data, the student should be able to identify, and systematically and accurately describe the chief gross anatomic alterations in the surgically removed specimens and be able to correctly diagnose at least 80% of the lesions received on an average day from the surgical service of an average teaching hospital.
- A student should be able to demonstrate ability to perform a systematic gross examination of the tissues including the taking of appropriate tissue sections and in special cases as in intestinal mucosal biopsies, muscle biopsies and nerve biopsies, demonstrate the orientation of tissues in paraffin blocks.
- The student should be able to identify and systematically and accurately describe the chief histo-morphological alterations in the tissue received in the surgical pathology service. He/she should also correctly interpret and correlate with the clinical data to diagnose at least 90% of the routine surgical material received on an average day.
- Be conversant with automatic tissue processing machine and the principles of its running.
- Process a tissue, make a paraffin block and cut sections of good quality on a rotary microtome.
- Stain paraffin sections with at least the following:
 - (i) Haematoxylin and eosin
 - (ii) Stains for collagen, elastic fibers and reticulin
 - (iii) Iron stain
 - (iv) PAS stain
 - (v) Acid fast stains
 - (vi) Any other stains needed for diagnosis.
- Demonstrate understanding of the principles of:

- (i) Fixation of tissues
 - (ii) Processing of tissues for section cutting
 - (iii) Section cutting and maintenance of related equipment
 - (iv) Differential (special) stains and their utility
- Cut a frozen section using cryostat, stain and interpret the slide in correlation with the clinical data provided.
 - Demonstrate the understanding of the utility of various immuno-histochemical stains especially in the diagnosis of tumour subtypes.

Cytopathology

Skills

- Independently prepare and stain good quality smears for cytopathologic examination.
- Be conversant with the techniques for concentration of specimens: i.e. various filters, centrifuge and cytocentrifuge.
- Independently be able to perform fine needle aspiration of all lumps in patients; make good quality smears, and be able to decide on the types of staining in a given case.
- Given the relevant clinical data, he/she should be able to independently and correctly:
 - (i) Diagnose at least 75% of the cases received in a routine laboratory and categorize them into negative, inconclusive and positive.
 - (ii) Demonstrate ability in the technique of screening and dotting the slides for suspicious cells.
 - (iii) Indicate correctly the type of tumour, if present
 - (iv) Identify with reasonable accuracy the presence of organisms, fungi and parasites

Haematology

Skills

- Correctly and independently perform the following special tests, in addition to doing the routine blood counts:
 - (i) Haemogram including reticulocyte and platelet counts.
 - (ii) Bone marrow staining including stain for iron
 - (iii) Blood smear staining
 - (iv) Cytochemical characterization of leukemia with special stains like Peroxidase, Leukocyte Alkaline Phosphatase (LAP), PAS, Sudan Black, etc.
 - (v) Hemolytic anemia profile including HPLC, Hb electrophoresis etc.
 - (vi) Coagulation profile including PT, APTT, FDP.
 - (vii) BM aspiration and BM biopsy

- Demonstrate familiarity with the principle and interpretation of results and the utility in diagnosis of the following:
 - (i) Platelet function tests including platelet aggregation and adhesion and PF3 release
 - (ii) Thrombophilia profile: Lupus anticoagulant (LAC), Anticardiolipin Antibody (ACA), Activated Protein C Resistance (APCR), Protein C (Pr C), Protein S (Pr S) and Antithrombin III (AT III)
 - (iii) Immunophenotyping of leukaemia
 - (iv) Cytogenetics
 - (v) Molecular diagnostics.

- Describe accurately the morphologic findings in the peripheral and bone marrow smears, identifying and quantitating the morphologic abnormalities in disease states and arriving at a correct diagnosis in at least

90% of the cases referred to the Haematology clinic, given the relevant clinical data.

Laboratory Medicine

Skills

- Plan a strategy of laboratory investigation of a given case, given the relevant clinical history and physical findings in a logical sequence, with a rational explanation of each step; be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.
 - Demonstrate familiarity with and successfully perform:
 - i) routine urinalysis including physical, chemical and microscopic, examination of the sediment.
 - ii) macroscopic and microscopic examination of faeces and identify the ova and cysts of common parasites.
 - iii) a complete examination: physical, chemical and cell content of Cerebrospinal Fluid (C.S.F), pleural and peritoneal fluid.
 - iv) semen analysis.
 - v) examination of peripheral blood for commonly occurring parasites.
- <
- Independently and correctly perform at least the following quantitative estimations by manual techniques and/or automated techniques.
 - (i) Blood urea
 - (ii) Blood sugar
 - (iii) Serum proteins (total and fractional)
 - (iv) Serum bilirubin (total and fractional)
 - Demonstrate familiarity with the following quantitative estimations of blood/ serum by Automated Techniques:

Serum cholesterol, Uric acid, Serum Transaminases (ALT and AST/SGOT and SGPT), etc.

- Prepare standard solutions and reagents relevant to the above tests, including the preparation of normal solution, molar solution and buffers.
- Explain the principles of Instrumentation, use and application of the instruments commonly used in the labs eg. Photoelectric colorimeter, Spectrophotometer, pH meter, Centrifuge, Electrophoresis apparatus, ELISA Reader, flow cytometer, PCR, chemiluminiscence.

Transfusion Medicine

Skills

The student should be able to correctly and independently perform the following:

- Selection and bleeding of donors
- Preparation of blood components i.e. Cryoprecipitates, Platelet concentrate, Fresh Frozen Plasma, Single Donor Plasma, Red Blood Cell concentrates.
- ABO and Rh grouping.
- Demonstrate familiarity with Antenatal and Neonatal work up.
 - (i) Direct antiglobulin test
 - (ii) Antibody screening and titre
 - (iii) Selection of blood for exchange transfusion
- Demonstrate familiarity with principle and procedures involved in:
 - (i) Resolving ABO grouping problems.
 - (ii) Identification of RBC antibody.
 - (iii) Investigation of transfusion reaction.
 - (iv) Testing of blood for presence of:
 - (a) HBV (Hepatitis B Virus Markers).
 - (b) HCV (Hepatitis C Virus Markers)
 - (c) HIV (Human Immunodeficiency Virus Testing)

- (d) VDRL
- (e) Malaria

Immunohistochemistry

Skills (desirable)

- Be able to perform immuno-histochemical staining using paraffin section with at least one of the commonly used antibodies (Cytokeratin or LCA) using PAP method.

COURSES OUTCOME

Syllabus

Course contents:

The study of Pathologic Anatomy includes all aspects of Pathology as encompassed in the branches of General and Systemic Pathology. Only the broad outlines are provided.

A) General Pathology:

Normal cell and tissue structure and function.

The changes in cellular structure and function in disease.

Causes of disease and its pathogenesis.

Reaction of cells, tissues, organ systems and the body as a whole to various sublethal and lethal injuries.

B) Systemic Pathology:

The study of normal structure and function of various organ systems and the aetiopathogenesis, gross and microscopic alterations of structure of these organ systems in disease and functional correlation with clinical features.

C) Haematology

The study of Haematology includes all aspects of the diseases of the blood and bone marrow. This would involve the study of the normal, and the causes of diseases and the changes thereof.

1. Laboratory Medicine (Clinical Biochemistry/Clinical Pathology including Parasitology).
2. Transfusion Medicine (Blood Banking).
3. The student is expected to acquire a general acquaintance of techniques and principles and to interpret data in the following fields.
 - a) Immunopathology
 - b) Electron microscopy
 - c) Histochemistry
 - d) Immunohistochemistry
 - e) Cytogenetics
 - f) Molecular Biology
 - g) Maintenance of records
 - h) Information retrieval, use of Computer and Internet in medicine.
 - i) Quality control, waste disposal

It is difficult to give a precise outline of the Course Contents for post graduate training. A post graduate is supposed to acquire not only the professional competence of a well-

trained specialist but also academic maturity, a capacity to reason and critically analyse scientific data as well as to keep himself abreast of the latest developments in the field of Pathology and related sciences. A brief outline of what is expected to be learnt during the MD Course is given under each head.

Surgical Pathology

Knowledge

- The student should be able to demonstrate an understanding of the histogenetic and patho-physiologic processes associated with various lesions.
- Should be able to identify problems in the laboratory and offer viable solutions.

Autopsy Pathology

Knowledge

- Should be aware of the technique of autopsy.
- Should have sufficient understanding of various disease processes so that a meaningful clinico-pathological correlation can be made.
- Demonstrate ability to perform a complete autopsy independently with some physical assistance, correctly following the prescribed instructions. Correctly identify all major lesions which have **caused, or contributed to the patient's death, on macroscopic examination alone and on microscopy in at least 90% of the autopsies in an average teaching hospital.**
- In places where non-medico-legal autopsies are not available each student should be made to observe at least five medico-legal autopsies.
- Write correctly and systematically Provisional and Final Anatomic Diagnosis reports.

Cytopathology

Knowledge

- Should possess the background necessary for the evaluation and reporting of

cytopathology specimens.

- Demonstrate familiarity with the following, keeping in mind the indication for the test.
 - (i) Choice of site from which smears may be taken
 - (ii) Type of samples
 - (iii) Method of obtaining various specimens (urine sample, gastric smear, colonic lavage etc.)
 - (iv) Be conversant with the principles and preparation of solutions of stains

Haematology

Knowledge

- Should demonstrate the capability of utilising the principles of the practice of Haematology for the planning of tests, interpretation and diagnosis of diseases of the blood and bone marrow.
- Should be conversant with various equipments used in the Haematology laboratory.
- Should have knowledge of automation and quality assurance in Haematology.
- Correctly plan a strategy of investigating at least 90% of the cases referred for special investigations in the Hematology Clinic and give ample justification for each step in consideration of the relevant clinical data provided.

Laboratory Medicine

Knowledge

- Possess knowledge of the normal range of values of the chemical content of body fluids, significance of the altered values and its interpretation.
- Possess knowledge of the principles of following specialized organ function tests and the relative utility and limitations of each and significance of the altered values.
 - (i) Renal function tests

- (ii) Liver function tests
- (iii) Pancreatic function tests
- (iv) Endocrine function tests
- (v) Tests for malabsorption

- Know the principles, advantages and disadvantages, scope and limitation of automation in the laboratory.
- Know the principles and methodology of quality control in the laboratory.

Transfusion Medicine (Blood Banking)

Knowledge

The student should possess knowledge of the following aspects of Transfusion Medicine.

- Basic immunology
- ABO and Rh groups
- Clinical significance of other blood groups
- Transfusion therapy including the use of whole blood and RBC concentrates
- Blood component therapy
- Rationale of pre-transfusion testing.
- Infections transmitted in blood.
- Adverse reactions to transfusion of blood and components
- Quality control in blood bank

Basic Sciences (in relation to Pathology)

a) Immunopathology

Knowledge

- Demonstrate familiarity with the current concepts of structure and function of the immune system, its aberrations and mechanisms thereof.
- Demonstrate familiarity with the scope, principles, limitations and interpretations of the results of the following procedures employed in

clinical and experimental studies relating to immunology.

- (a) ELISA techniques
- (b) Radioimmunoassay
- (c) HLA typing
- Interpret simple immunological tests used in diagnosis of diseases and in research procedures.
 - (i) Immunoelectrophoresis
 - (ii) Immunofluorescence techniques especially on kidney and skin biopsies
 - (iii) Anti-nuclear antibody (ANA)
 - (iv) Anti-neutrophil cytoplasmic antibody (ANCA)

b) Electron Microscopy

Knowledge

- Demonstrate familiarity with the principles and techniques of electron microscopy and the working of an electron microscope (including Transmission and Scanning Electron microscope: TEM and SEM)
- Recognise the appearance of the normal subcellular organelles and their common abnormalities (when provided with appropriate photographs).

c) Enzyme Histochemistry

Knowledge

- Should be familiar with the principles, use and interpretation of common enzyme histochemical procedures (Alkaline Phosphatase, Acid Phosphatase, Glucose-6-Phosphate Dehydrogenase, Chloroacetate Esterase).

d) Immunohistochemistry

Knowledge

- Demonstrate familiarity with the principles and exact procedures of various immunohistochemical stains using both PAP (Peroxidase-anti-peroxidase) and AP-AAP (Alk. Phosphatase-anti-Alk. Phosphatase) ABC (Avidin-Biotin Conjugate) systems; employing monoclonal and polyclonal antibodies.
- Be aware of the limitations of immuno-histochemistry.

e) Molecular Biology

Knowledge

- Should understand the principles of molecular biology especially related to the understanding of disease processes and its use in various diagnostic tests.
- Should be conversant with the principle and steps and interpretation of Polymerase Chain Reaction (PCR), Western Blot, Southern Blot, Northern Blot and Hybridisation) procedures.

f) Cytogenetics

Knowledge

- Demonstrate familiarity with methods of Karyotyping and Fluorescent in-situ Hybridisation (FISH).

g) Tissue Culture

Knowledge

- Demonstrate familiarity with methods of tissue culture.

h) Principles of Medical Statistics

Knowledge

- Demonstrate familiarity with importance of statistical methods in assessing data from patient material and experimental studies.

MD-COMMUNITY MEDICINE

Program Outcomes:

PO1. To create a skilled cadre of medical professionals having expertise in application of principles of Public Health, Community Medicine and applied epidemiology, contributing meaningfully in formulating National Health Policies & Programmes with a systems approach for overall human development.

PO2. To standardize the teaching & training approaches at post-graduate level, for Community Medicine.

PO3. To formulate research questions, do literature search conduct study with an appropriate study design and study tool, conduct data collection and management, data analysis and report.

SUBJECT SPECIFIC COMPETENCIES

At the end of the course the student should be able to acquire the following competencies under

the three domains, Cognitive, Affective and Psychomotor:

A. Cognitive domain (The student should be able to:)

1. Describe conceptual (and applied) understanding of Public Health, Community Medicine, clinical and disease-oriented approach, preventive approach & health promotion, disease control & promotion.
2. Have knowledge about communicable and non-communicable diseases, emerging and re-emerging diseases, their epidemiology, control and prevention.
3. Apply the principles of epidemiology, health research and Biostatistics, application of qualitative research methods
4. Calculate Odds Ratio, Relative Risk, Attributable risk and other relevant health and morbidity indicators.

5. To describe nutritional problems of the country, role of nutrition in health and disease and to describe common nutritional disorders
6. Develop nutrition plan for an individual based on his requirements and with concerns to special situations if applicable
7. Plan comprehensive programme to address issue of malnutrition in a given area for a specific group
8. To describe the concept of Environmental Health and its various determinants.
9. Identify environmental health issues in a given area/community
10. Assess impact of adverse environmental conditions on health of human beings
11. Plan awareness programmes at various levels on environmental issues and mobilize community resources and participation to safeguard from local adverse environmental conditions
12. Should be able to provide technical advice for water purification, chlorination, installing gas plant, construction of soakage pits etc.
13. Be a technical expert to advice on protection measures from adverse environmental exposure
14. To describe the working of Primary Health Care system, Panchayat Raj system, National Health Programmes, urban/rural differences, RCH, Demography and Family Welfare.
15. Do orientation of the inter-linkage of health sector and non-health sector for promotion of Health & control and prevention of diseases.
16. Have familiarity with administrative procedures and protocols
17. Have knowledge about role of media and its use in health.
18. Have knowledge of Health Care Administration, Health Management and Public Health Leadership
19. To describe Health Policy planning, Medical Education technology, Information Technology and integration of alternative Health system including AYUSH.
20. To describe the intricacies of Social & Behavioral sciences and their applications.
21. To describe Public Health Legislations
22. To understand and describe International Health & Global Diseases surveillance.
23. To relate the history of symptoms with specific occupation, diagnostic criteria, preventive measures, identification of various hazards in a specific occupational environment and legislations.
24. To keep abreast of recent advances in Public Health & formulate feasible, optimal, sustainable, cost effective strategies in response to the advances in public health & development.

25. To describe the principles of Health Economics and apply it in various public health settings.
26. To explain and correlate common health problems (medical, social, environmental, economic, psychological) of urban slum dwellers, organization of health services in urban slum areas
27. Develop workable interventions for control and prevention of emerging and re-emerging diseases at local, national and global level.
28. Identify behavior pattern of individual or group of individuals detrimental or adversely affecting their health
29. Define and identify vulnerable, under privileged high risk communities and their special needs
30. To create awareness about various public health laws
 31. Evaluate cost effectiveness and cost benefits of a Health Program
 32. Understand and express implications of 'Poverty Line', 'Social Inclusion', 'Equity', 'taxations', 'Insurance' on Health care management.
 33. To categorize hospital waste and be able to guide for proper disposal.
 34. To provide a comprehensive plan for disaster management and mitigation of sufferings.

B. Affective domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

COUSRE OUTCOME

Syllabus

Course contents:

1.

Conceptual (and applied) understanding of Public Health, Community Medicine, clinical disease-oriented approach, Preventive approach & Health promotion, disease control & promotion.

Learning objectives:

At the end of this course topic, the student should be able to:-

i.

Understand and explain the concept & application and give suitable analogies/examples related

to Public Health/Community Medicine (with differences), Disease-oriented v/s Preventive

approach, health promotion disease control & prevention.

ii.

Explain correlation between health and human development with analogies/ examples.

iii.

Explain concept of Primordial, Primary, Secondary and Tertiary prevention with examples.

v. Evolutionary History and mile-stones in Public Health –

National and International levels.

2. Communicable and Non-Communicable diseases, emerging and re-emerging diseases**Learning objectives:**

At the end of this course, the student should be able to:-

i. Understand and explain Epidemiology of Communicable/Non-communicable diseases- its

causes, precipitating factors, social & other non-

health causes, mechanisms of transmission,

signs/systems, management, control & prevention measures, related national Health

Programmes & national Guidelines, Directives, special projects, if any.

ii.

Explain application of Disease surveillance system in control of Communicable/Non-

communicable diseases.

iii.

Explain & undertake steps to investigate & control outbreaks, epidemics and take measures to

prevent the same.

iv.

Evolve prevention & control measures based on local & regional epidemiological funding,

synchronizing with National guidelines.

3. Applied Epidemiology, Health research, Bio-statistics

Learning objectives:

At the end of this course, the student should be able to:-

i.

Explain the concept & application of Epidemiology of Disease and Health giving suitable examples.

ii.

Explain Epidemiological approach, the terms Distribution & Determinants, uses, types of

Epidemiological studies, interpretation, merits/demerits and limitations, odds ratio, relative risk,

attributable & population attributable risks, Hybrid designs (with examples), validity of

Epidemiological Data and application in practice at field level.

iii.

Explain Epidemiological Research methods, Research related protocols, Literature review,

estimating sample size, data collection/ compilation/Analysis/ Research, interpretation.

iv.

Develop Health interventional programs based on Epidemiological Finding & create evidence

for Public Health action.

v.

Understand difference between data, information & intelligence, types of data, survey methods,

formulating questionnaires, interview schedule, data presentation types & analysis.

vi.

Apply computer based software application for data designing, data management & collation

analysis e.g. SPSS, Epi-info, MS office and other advanced versions.

4. Nutrition**Learning objectives:**

At the end of this course, the student should be able to:-

i.

Identify various nutritional problems in the region, state and country and contributing factors for

the same, with due emphasis on ecology perspectives.

- ii. Explain importance of various nutrients (including micronutrients) in health, their sources, requirements and problems associated with their deficiencies as well as over consumption.
- iii. Plan balanced diet and dietary requirements of various age and sex groups.
- iv. Dietary/nutritional concerns of vulnerable groups – young children, adolescents, ANC/PNC/Lactating mothers/senior citizens/individuals with various health problems e.g hypertension, diabetes, renal problems etc.
- v. Classification of food, food additives, food fortification, food enrichment, food toxins and food adulteration.
- vi. Explain Food production, Food hygiene and safety, food storage, food preparation, food wastage and feeding practices.
- vii. Assessment of nutritional status of a community by adopting different methodologies.
- viii. Nutritional supplementation, surveillance, education and rehabilitation.
- ix. National programmes in nutrition and their evaluation
- x. National nutrition policy.

5. Environmental health

Learning objectives:

At the end of this course, the student should be able to:-

- i. Highlight importance of external environment (air, water, noise, radiation, temperature, ventilation, solid waste disposal, insects and vectors, domestic and country yard pests, industrial waste disposal etc. and its impact on ecology and human health).
- ii. Elaborate on health issues related to housing, air, water, noise, radiation pollution i.e. size of

problems, area and specific groups affected, measurement of pollution levels and health impact

of the same, corrective measures

iii.

Elaborate on requirements of water, water chlorination and household purification measures,

measurement of chlorine demand, Break-point chlorination levels, water quality.

iv. Assessment of quality of water and air, control of air pollution

v.

Explain environmental sanitation and control measures (including appropriate technologies) –

modern methods of sewage disposal, mechanical ventilation, soakage pits, gobar gas plants,

smokeless Chula, solar energy, rainwater harvesting, sewage water recycling plants at society

level etc.

vi. Explain global warming and its health impact.

vii. Elaborate on forest reserves, social forestry and health

viii.

Study vectors of medical importance and integrated control measures against them.

ix. Explain dynamics of transmission of vector borne diseases

x. Explain pest control measures

xi. Explain environmental health issues in urban and rural areas

xii.

Understand functioning of public sector measures to safeguard environmental health e.g water

purification plant

xiii. Explain Legislative measures for protection of environmental health

6.

Primary Health Care System, Panchayat Raj, National Health Programmes including

RCH, Demography & Family Welfare:

Learning Objectives

At the end of this course, the student should be able to:-

i.

Explain the meaning of Primary Health Care with suitable analogies with reference to India, and

be able to define the systems approach for implementation of Primary Health Care.

ii.

Enumerate the elements, principles, population coverage norms, staff patterns, day to day activities, programme schedule, stakeholders at PHC level.

iii. Explain the scope and implications of 3-tier system of Primary Health Care.

iv.

Understand functioning of Rural Panchayat Raj system of development and its co-relation with health.

v.

Promote community participation in Primary Health Care programme and motivate various stakeholders for the same.

vi. Understand and comply with medico-legal procedures related to Primary Health Care activities.

vii. Integrate, coordinate both health and non-health sectors for implementing various national health programmes.

- viii. Deliver the provisions of various health schemes to eligible beneficiaries such as Janani Suraksha Yojana, Rashtriya Swasthya Beema Yojana, Rajiv Gandhi Jeevandayi Arogya Yojana etc.
- ix. Impart training in health programmes for paramedical workers, lab technicians, community health volunteer's, interns and provide health education in the community.
- x. Implement Public Health Skills for investigations and containment of outbreaks & epidemics.
- xi. Understand history of evolution of public health, important milestones in the world and in India.
- xii. Enumerate the various health committees established and their major recommendations since 1947-48 to till date.

7. Health Care Administration, Health Management and Public Health Leadership

Learning Objectives:

At the end of this course, the student should be able to:-

- i. Explain the conceptual difference between Administration and Management, Power and Authority with reference to health care.
- ii. Explain the role of fundamental principles of constitution, principles of Democracy and its correlation with health care administration.
- iii. Explain the role of Bureaucracy, Technocracy, Political system, Judiciary, Media and people in health care administration.
- iv. Explain and identify the key positions and their role in health administration at State, District, Taluka (Tehsil block) and village level.
- v. Explain the frame work of health care system at State, District, Taluka & village level and understand the mechanism of coordination between bureaucrats, technocrats, political, judiciary and media at each of these levels.
- vi. Enumerate functions of a manager, explain concepts of management and leadership styles, various management techniques, planning process, monitoring & evaluation skills.
- vii. Should be sensitive to quality issues in health care management and comply with relevant quality management techniques.
- viii. Formulate and manage team approach for implementing health programmes.
- ix. Apply skills of effective human resource management and identify relevant roles, responsibilities and duties of functionaries.
- x. Implement skills of motivation, communication, negotiation and conflict management at PHC level.
- xi. Develop budgetary statements based on evidence of needs assessment and be able to maintain account of expenditure as per norms.
- xii. Undertake community health needs survey, conduct training & communication needs assessment of paramedical and health workers, identify vulnerable, underprivileged communities, implements high risk approach.

8. Health Policy, Medical Education, Integrating Alternative system of Medicine

Learning Objectives

At the end of this course, the student should be able to:-

- i. Understand and elaborate implications of the policy provision with reference to the current health scenario in the country.
- ii. Explain the role of health policy in promotion of Primary Health care, ensuring equity, inter-sectoral co-ordination, appropriate technology and community participation.
- iii. Explain the various provisions for promotion of preventive and curative health services including National Health Mission, National Health Programs, Quality Hospital based services, Medical Education and AYUSH.
- iv. Critically appreciate merits and demerits of the Health Policy.
- v. Explain SWOT analysis of the policy and debate on evidence based recommendations, additions, deletions.
- vi. Debate on suggestions or recommendations for future inclusions.

9. Social and behavioral sciences

Learning objectives:

At the end of this course, the student should be able to:-

- i. Understand influence of social and behavioral practices on health.
- ii. Understand principles of behavior change of an individual and community. Clearly understand difference between knowledge, attitude and practices..
- iii. Understand importance of social medicine and health.
- iv. Importance of behavior change communication (BCC).
- v. Socio-cultural factors influencing behavior change.
- vi. Formal and informal organizations in the community.
- vii. Influence of peer pressure.
- viii. Know the health problems, where BCC interventions are necessary.
- ix. Understand factors promoting and detrimental to BCC.

11. Public Health Legislations

Learning objectives:

At the end of this course, the student should be able to:-

- i. Explain public health legislations and need for the same.
- ii. Know in detail each public health law – when, why, implementation, impact, issues etc.
- iii. Enforcement of various public health laws.
- iv. Judiciary mechanism for ensuring proper implementation of public health laws.
- v. Scope for integrated approach for implementation of public health laws.

12. International Health

Learning Objectives:

At the end of this course, the student should be able to:-

- i. Understand the need and scope for international health measures.
- ii. Enlist and understand functioning of various UN agencies (including WHO) playing key role in international health.
- iii. Enlist and understand functioning of bilateral vs multilateral international donor agencies.
- iv. Provide advice to international travelers and vaccination requirements,
- v. Understand International health control measures e.g. quarantine, airport management etc.
- vi. Understand the management of international ports from health perspectives.

13. Occupational Health

Learning Objectives:

At the end of this course, the student should be able to:-

- i. Understand the concept of occupational health and its importance, Occupational environment and work dynamics.
- ii. Know different types of occupational exposures at various settings.
- iii. Enlist various occupational hazards and their relative magnitude.
- iv. Understand measurement of exposure levels to harmful influences during occupation.
- v. Understand preventive and control measures against various occupational hazards – global, national and local level measures.
- vi. Understand individual and community responses towards preventing exposure to occupational hazards.
- vii. Understand and advise occupational safety measures.
- viii. Understand legislative measures to prevent exposures to occupational hazards.
- ix. Advise compensation provisions to persons exposed to various occupational hazards.
- x. Understand occupational health problems amongst people in unorganized sector
- xi. Understand and advise social security and welfare provisions for workers – ESIS, Factory's Act, Role of ILO, Ministry of Labor, DGFASLI.

14. The recent advances in Public Health & miscellaneous issues

Learning Objectives:

At the end of this course, the student should be able to:-

- i. identify & enlist events at local, district, national & global levels influencing or adversely affecting health /medical issues of the population.
- ii. Adopt & practise skills related to utilization of modern technology, software, IT application in the interest of health promotion & disease prevention.

15. Health Economics

Learning Objectives:

At the end of this course, the student should be able to: -

- i. Describe the scope of health economics.

- ii. Understand health market & its characteristics.
- iii. Understand & apply economic evaluation techniques.
- iv.

Assess the mechanism of Funding Health Care services, especially health insurance.

- v. Advise on allocation of resources appropriately in their work area.

MD-GENERAL MEDICINE

Program Outcomes:

The intended outcome of course is a consultant specialist who can practice medicine at a defined level of competency in different practice settings. i.e. ambulatory (outpatient), inpatient, intensive care and emergency medicine.

The student is expected to know his subject in depth; however, emphasis should be on the diseases/health problems most prevalent in that area. Knowledge of recent advances and basic sciences as applicable to his/her specialty should get high priority

Postgraduate training should enable the student to:

KNOWLEDGE

PO1. Practice efficiently internal medicine specialty, backed by scientific knowledge including basic sciences and skills

PO2. Diagnose and manage majority of conditions in his specialty (clinically and with the help of relevant investigations

PO4. Plan and deliver comprehensive treatment using the principles of rational drug therapy

PO5. Plan and advise measures for the prevention and rehabilitation of patients belonging to his specialty.

PO6. Manage emergencies efficiently.

PO7. Recognize conditions that may be outside the area of the specialty/competence and refer them to an appropriate specialist.

PO8. Demonstrate skills in documentation of case details including epidemiological data

PO10. Demonstrate competence in basic concepts of research methodology and clinical epidemiology, and preventive aspects of various disease states

PO11. Be well versed with his medico-legal responsibilities

SKILLS

PO12. Basic Life Support (BLS) and Advanced Life Support (ALS) in emergency situations

PO13. Procedural skills- to do basic & advanced bed side procedures

PO14. To develop communication skills to communicate with patient & relatives regarding disease process, outcome, breaking bad news. Communication & interpersonal skills with paramedical staff.

PO15. Be a motivated 'teacher' - defined as one keen to share knowledge and skills with a colleague or a junior or any learner.

PO16. Should develop Leadership skills & skill to work in a team.

PO17. Undertake audit, use information technology tools and carry out research - both basic and clinical, with the aim of publishing the work and presenting the work at scientific forums.

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive domain

By the end of the course, the student should have acquired knowledge (cognitive domain), professionalism (affective domain) and skills (psychomotor domain) as given below:

Basic Sciences

1. Basics of human anatomy as relevant to clinical practice e.g. surface anatomy of various viscera, neuro-anatomy, important structures/organs location in different anatomical locations in the body; common congenital anomalies
2. Basic functioning of various organ-system, control of vital functions, patho-

physiological alteration in diseased states, interpretation of symptoms and signs in relation to patho-physiology.

3. Common pathological changes in various organs associated with diseases and their correlation with clinical signs; understanding various pathogenic processes and possible therapeutic interventions possible at various levels to reverse or arrest the progress of diseases.
4. Knowledge about various microorganisms, their special characteristics important for their pathogenetic potential or of diagnostic help; important organisms associated with tropical diseases, their growth pattern/life-cycles, levels of therapeutic interventions possible in preventing and/or eradicating the organisms.
5. Knowledge about pharmacokinetics and pharmaco-dynamics of the drugs used for the management of common problems in a normal person and in patients with diseases kidneys/liver etc. which may need alteration in metabolism/excretion of the drugs; rational use of available drugs.
6. Knowledge about various poisons with specific reference to different geographical and clinical settings, diagnosis and management.
7. Research Methodology and Studies, epidemiology and basic Biostatistics.
8. National Health Programmes.
9. Biochemical basis of various diseases including fluid and electrolyte disorders; Acid base disorders etc.
10. Recent advances in relevant basic science subjects.

Systemic Medicine

1. Preventive and environmental issues, including principles of preventive health care, immunization and occupational, environmental medicine and bio-terrorism.
2. Aging and Geriatric Medicine including Biology, epidemiology and neuro-psychiatric aspects of aging.

3. Clinical Pharmacology - principles of drug therapy, biology of addiction and complementary and alternative medicine.
4. Genetics - overview of the paradigm of genetic contribution to health and disease, principles of Human Genetics, single gene and chromosomal disorders and gene therapy.
5. Immunology - The innate and adaptive immune systems, mechanisms of immune mediated cell injury and transplantation immunology
6. Cardio-vascular diseases - Approach to the patient with possible cardio-vascular diseases, heart failure, arrhythmias, hypertension, coronary artery disease, valvular heart disease, infective endocarditis, diseases of the myocardium and pericardium and diseases of the aorta and peripheral vascular system.
7. Respiratory system - approach to the patient with respiratory disease, disorders of ventilation, asthma, Congenital Obstructive Pulmonary Disease (COPD), Pneumonia, pulmonary embolism, cystic fibrosis, obstructive sleep apnoea syndrome and diseases of the chest wall, pleura and mediastinum.
8. Nephrology - approach to the patient with renal diseases, acid-base disorders, acute kidney injury, chronic kidney disease, tubulo-interstitial diseases, nephrolithiasis, Diabetes and the kidney, obstructive uropathy and treatment of irreversible renal failure.
9. Gastro-intestinal diseases - approach to the patient with gastrointestinal diseases, gastrointestinal endoscopy, motility disorders, diseases of the oesophagus, acid peptic disease, functional gastrointestinal disorders, diarrhea, irritable bowel syndrome, pancreatitis and diseases of the rectum and anus.
10. Diseases of the liver and gall bladder - approach to the patient with liver disease, acute viral hepatitis, chronic hepatitis, alcoholic and non-alcoholic

steatohepatitis, cirrhosis and its sequelae, hepatic failure and liver transplantation and diseases of the gall bladder and bile ducts.

11. Haematologic diseases - haematopoiesis, anaemias, leucopenia and leucocytosis, myelo-proliferative disorders, disorders of haemostasis and haemopoietic stem cell transplantation.
12. Oncology - epidemiology, biology and genetics of cancer, paraneoplastic syndromes and endocrine manifestations of tumours, leukemias and lymphomas, cancers of various organ systems and cancer chemotherapy.
13. Metabolic diseases - inborn errors of metabolism and disorders of metabolism.
14. Nutritional diseases - nutritional assessment, enteral and parenteral nutrition, obesity and eating disorders.
15. Endocrine - principles of endocrinology, diseases of various endocrine organs including diabetes mellitus.
16. Rheumatic diseases - approach to the patient with rheumatic diseases, osteoarthritis, rheumatoid arthritis, spondyloarthropathies, systemic lupus erythematosus (SLE), polymyalgia, rheumatic fibromyalgia and amyloidosis.
17. Infectious diseases - Basic consideration in Infectious Diseases, clinical syndromes, community acquired clinical syndromes. Nosocomial infections, Bacterial diseases - General consideration, diseases caused by gram - positive bacteria, diseases caused by gram - negative bacteria, miscellaneous bacterial infections, Mycobacterial diseases, Spirochetal diseases, Rickettsia, Mycoplasma and Chlamydia, viral diseases, DNA viruses, DNA and RNA respiratory viruses, RNA viruses, fungal infections, protozoal and helminthic infections .
18. Neurology - approach to the patient with neurologic disease, headache, seizure disorders and epilepsy, coma, disorders of sleep, cerebrovascular diseases,

Parkinson's disease and other movement disorders, motor neuron disease, meningitis and encephalitis, peripheral neuropathies, muscle diseases, diseases of neuromuscular transmission and autonomic disorders and their management.

19. The mental condition characterized by complete self absorption with reduced ability to communicate with the outside world (Autism), abnormal functioning in social interaction with or without repetitive behaviour and/or poor communication etc.
20. Dermatology - Structure and functions of skin, infections of skin, papulo-squamous and inflammatory skin rashes, photo-dermatology, erythroderma, cutaneous manifestations of systematic diseases, bullous diseases, drug induced rashes, disorders of hair and nails, principles of topical therapy.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

Clinical Assessment Skills

Elicit a detailed clinical history

Perform a thorough physical examination of all the systems

Procedural skills

Test dose administration

- Mantoux test
- Sampling of fluid for culture
- IV- Infusions
- Intravenous injections
- Intravenous cannulation
- ECG recording
- Pleural tap
- Lumbar puncture
- Cardiac
 - TMT
 - Holter Monitoring
 - Echocardiogram
 - Doppler studies
- Cardio Pulmonary Resuscitation (CPR)
- Central venous line insertion, CVP monitoring
- Blood and blood components matching and transfusions
- Arterial puncture for ABG
- Fine needle aspiration cytology (FNAC) from palpable lumps
- Bone marrow aspiration and biopsy
- Abdominal paracentesis - diagnostic
- Aspiration of liver abscess
- Pericardiocentesis
- Joint fluid aspiration
- Liver biopsy
- Nerve/ muscle/ skin/ kidney/ pleural biopsy

- Ultrasound abdomen, echocardiography
- Upper GI endoscopy, procto-sigmoidoscopy

Respiratory management

- Nebulization
- Inhaler therapy
- Oxygen delivery

Critically ill person

- Monitoring a sick person
- Endotracheal intubation
- CPR
- Using a defibrillator
- Pulse oximetry
- Feeding tube/Ryle's tube, stomach wash
- Naso-gastric intubation
 - Urinary catheterization – male and female
 - Prognostication
 - Haemodialysis

Neurology- interpret

- **Nerve Conduction studies**
- **EEG**
- Evoked Potential interpretation
- Certification of Brain death
- Intercostal tube placement with underwater seal Thoracocentesis
- Sedation
- Analgesia

Laboratory-Diagnostic Abilities

- Urine protein, sugar, microscopy

- Peripheral blood smear
- Malarial smear
- Ziehl Nielson smear-sputum, gastric aspirate
- Gram's stain smear-CSF, pus
- Stool pH, occult blood, microscopy
- KOH smear
- Cell count - CSF, pleural, peritoneal, any serous fluid

Observes the procedure

- Subdural, ventricular tap
- Joint Aspiration – Injection
- *Endoscopic Retrograde Cholangio- Pancreatography (ERCP)*
- Peritoneal dialysis

Interpretation Skills

Clinical data (history and examination findings), formulating a differential diagnosis in order of priority, using principles of clinical decision making, plan investigative work-up, keeping in mind the cost-effective approach i.e. problem solving and clinical decision-making.

- Blood, urine, CSF and fluid investigations - hematology, biochemistry
- X-ray chest, abdomen, bone and joints
- ECG
- Treadmill testing
- ABG analysis
- Ultrasonography
- CT scan chest and abdomen
- CT scan head and spine
- MRI

- Barium studies
- IVP, VUR studies
- Pulmonary function tests
- Immunological investigations
- Echocardiographic studies

Interpretation under supervision

- Hemodynamic monitoring
 - Nuclear isotope scanning
 - MRI spectroscopy/SPECT
 - Ultrasound guided aspiration and biopsies

Communication skills

- While eliciting clinical history and performing physical examination
- Communicating health, and disease
- Communicating about a seriously ill or mentally abnormal
- Communicating death
- Informed consent
- Empathy with patient and family members
- Referral letters, and replies
- Discharge summaries
- Death certificates
- Pre-test counseling for HIV
- Post-test counseling for HIV

Pedagogy -teaching students, other health functionaries-lectures, bedside clinics, discussions

Health education - prevention of common medical problems, promoting healthy

life-style, immunization, periodic health screening, counseling skills in risk factors for common malignancies, cardiovascular disease, AIDS

Dietary counseling in health and disease

Case presentation skills including recording case history/examination, preparing follow-up notes, preparing referral notes, oral presentation of new cases/follow-up cases

Co-coordinating care - team work (with house staff, nurses, faculty etc.)

- Linking patients with community resources
- Providing referral
- Genetic counseling

Others

- *Demonstrating*
 - professionalism
 - ethical behavior (humane and professional care to patients)
- *Utilization of information technology*
 - Medline search, Internet access, computer usage
- *Research methodology*
 - designing a study
 - interpretation and presentation of scientific data
- *Self-directed learning*
 - identifying key information sources
 - literature searches
 - information management
- *Therapeutic decision-making*
 - managing multiple problems simultaneously
 - assessing risks, benefits and costs of treatment options

- involving patients in decision-making
- selecting specific drugs within classes
- Rational use of drugs

MD-PAEDIATRICS

Program Outcomes:

PO1. Recognizes the health needs of infants, children and adolescents and carries out professional obligations in keeping with principles of the National Health Policy and professional ethics

PO2. Has acquired the competencies pertaining to Paediatrics that are required to be practiced in the community and at all levels of health system

PO3. Has acquired skills in effectively communicating with the child, family and the community

PO4. Is aware of contemporary advances and developments in medical sciences as related to child health

PO5. Is oriented to principles of research methodology

PO6. Has acquired skills in educating medical and paramedical professionals

PO7. Is able to recognize mental conditions and collaborate with Psychiatrists/Child Psychologists for the treatment of such patients

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive domain

At the end of the MD course in Paediatrics, the students should be able to:

1. Recognize the key importance of child health in the context of the health priority of country
2. Practice the specialty of Paediatrics in keeping with the principles of professional ethics
3. Identify social, economic, environmental, biological and emotional determinants

- of child and adolescent health, and institute diagnostic, therapeutic, rehabilitative, preventive and promotive measures to provide holistic care to children
4. Recognize the importance of growth and development as the foundation of Paediatrics and help each child realize her/his optimal potential in this regard
 5. Take detailed history; perform full physical examination including neuro-development and behavioral assessment and anthropometric measurements in the child and make clinical diagnosis
 6. Perform relevant investigative and therapeutic procedures for the paediatric patient
 7. Interpret important imaging and laboratory results
 8. Diagnose illness based on the analysis of history, physical examination and investigations
 9. Plan and deliver comprehensive treatment for illness using principles of rational drug therapy
 10. Plan and advice measures for the prevention of childhood disease and disability
 11. Plan rehabilitation of children with chronic illness and handicap and those with special needs
 12. Manage childhood emergencies efficiently
 13. Provide comprehensive care to normal, 'at risk' and sick neonates
 14. Demonstrate skills in documentation of case details, and of morbidity and mortality data relevant to the assigned situation
 15. Recognize the emotional and behavioral characteristics of children, and keep these fundamental attributes in focus while dealing with them
 16. Demonstrate empathy and humane approach towards patients and their families and keep their sensibilities in high esteem
 17. Demonstrate communication skills of a high order in explaining management and prognosis, providing counseling and giving health education messages to patients, families and communities
 18. Develop skills as a self-directed learner. Recognize continuing educational needs; use appropriate learning resources and critically analyze published literature in order to practice evidence-based Paediatrics
 19. Demonstrate competence in basic concepts of research methodology and epidemiology
 20. Facilitate learning of medical/nursing students, practicing physicians, paramedical health workers and other providers as a teacher-trainer
 21. Implement National Health Programs, effectively and responsibly
 22. Organize and supervise the desired managerial and leadership skills
 23. Function as a productive member of a team engaged in health care, research and education.
 24. Recognize mental conditions, characterized by self absorption, reduced ability to respond, abnormal functioning in social interaction with or without repetitive behavior, poor communication (autism) and collaborate with Psychiatrists/Child Psychologists for the treatment of such patients.

All PG students joining the course should have an orientation session to acquaint them with the requirements and other details. A plan for orientation session has been given at Annexure 1.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should have acquired following skills:

I. History and Examination

The student must gain proficiency in eliciting, processing and systemically presenting Paediatrics history and examination with due emphasis of the important and minimization of less important facts. The following skills must be achieved:

- i) Recognition and demonstration of physical findings
- ii) Recording of height, weight, head circumference and mid arm circumference and interpretation of these parameters using growth reference standard assessment of nutritional status and growth
- iii) Assessment of pubertal growth
- iv) Complete development assessment by history and physical examination, and recognizing developmental disabilities, including autism
- v) Systematic examination
- vi) Neonatal examination including gestation assessment by physical neurological criteria

- vii) Examination of the fundus and the ear-drum
- viii) Skills related to IMNCI and IYCF

II. Monitoring Skills

Non-invasive monitoring of blood pressure, pulse and respiratory rates, saturation; ECG

III. Investigative Procedures

- i) Venous, capillary and arterial blood sampling using appropriate precautions
- ii) Pleural, peritoneal, pericardial aspiration; subdural, ventricular and lumbar puncture
- iii) Tuberculin test
- iv) Biopsy of liver and kidney
- v) Urethral catheterization and suprapubic tap
- vi) Gastric content aspiration

IV. Therapeutic Skills

- i) Breast feeding assessment and counseling; management of common problems
- ii) Establishment of central and peripheral vascular access; CVP monitoring
- iii) Administration of injections using safe injection practices
- iv) Determination of volume and composition of intravenous fluids and their administration
- v) Neonatal and Pediatric basic and advanced life support
- vi) Oxygen administration, CPAP and nebulization therapy
- vii) Blood and blood component therapy
- viii) Intraosseous fluid administration
- ix) Phototherapy, umbilical artery and venous catheterization and exchange transfusion
- x) Nasogastric feeding
- xi) Common dressings and abscess drainage; intercostal tube insertion
- xii) Basic principles of rehabilitation
- xiii) Peritoneal dialysis
- xiv) Mechanical ventilation

V. Bed side investigations, including

- i) Complete blood counts, micro ESR, peripheral smear
- ii) Urinalysis
- iii) Stool microscopy and hanging drop
- iv) Examination of CSF and other body fluids
- v) Blood sugar
- vi) Shake test on gastric aspirate

- vii) Gram stain, ZN stain

VI. Patient Management Skills

- i) Proficiency in management of pediatric emergencies, including emergency triaging
- ii) Drawing and executing patient management plan and long term care
- iii) Documenting patient records on day to day basis and problem oriented medical record
- iv) Care of a normal and sick newborn, management of neonatal disorders hypothermia, sepsis, convulsions, jaundice, metabolic problems
- v) Identifying need for timely referral to appropriate departments/health facility and pre-transport stabilization of the sick child

VII. Communication Skills; Attitudes; Professionalism

- i) Communicating with parents/child about nature of illness and management plan prognostication, breaking bad news
- ii) Counseling parents on breast feeding, nutrition, immunization, disease prevention, promoting healthy life style
- iii) Genetic counseling
- iv) Communication and relationship with colleagues, nurses and paramedical workers
- v) Appropriate relation with pharmaceutical industry
- vi) Health economics
- vii) Professional and research ethics

VIII. Interpretation of Investigations

- i. Plan x-ray chest, abdomen, skeletal system
- ii. Contrast radiological studies: Barium swallow, barium meal, barium enema, MCU
- iii. Ultrasound skull and abdomen
- iv. Histopathological, biochemical and microbiological investigations
- v. CT Scan and MRI (skull, abdomen, chest)
- vi. Electrocardiogram, electroencephalogram
- vii. Arterial and venous blood gases
- viii. **Desirable:** Interpretation of radio-isotope studies, audiogram, neurophysiological studies, (BERA, VER, Electromyography [EMG], Nerve Conduction Velocity [NCV]), lung function tests

IX. Academic Skills

- i. Familiarity with basic research methodology, basic IT skills. Planning the protocol of the thesis, its execution and final report
- ii. Review of literature

- iii. Conducting clinical sessions for undergraduates medical students
- iv. Desirable: writing and presenting a paper. Teaching sessions for nurses and medical workers

COURSES OUTCOMES

Syllabus

Course contents:

Guidelines

During the training period, effort must be made that adequate time is spent in discussing child health problems of public health importance in the country or particular region.

Basic Sciences

- Principles of inheritance, chromosomal disorders, single gene disorders, multifactorial / polygenic disorders, genetic diagnosis and prenatal diagnosis, pedigree drawing.
- Embryogenesis of different organ systems especially heart, genitourinary system, gastro-intestinal tract. Applied anatomy and functions of different organ systems.
- Physiology of micturition and defecation; placental physiology; fetal and neonatal circulation; regulation of temperature, blood pressure, acid base balance, fluid electrolyte balance and calcium metabolism.
- Vitamins and their functions.
- Hematopoiesis, hemostasis, bilirubin metabolism.
- Growth and development at different ages, growth charts; puberty and its regulation.
- Nutrition: requirements and sources of various nutrients.
- Pharmacokinetics of common drugs, microbial agents and their epidemiology.
- Basic immunology, biostatistics, clinical epidemiology, ethical and medico-legal issues.
- Teaching methodology and managerial skills.

Understanding the definition, epidemiology, aetiopathogenesis, presentation, complications, differential diagnosis and treatment of the following, but not limited to:

Growth and development

- | | |
|--|--|
| • principles of growth and development | • normal growth and development, |
| • normal growth and development | • sexual maturation and its disturbances |
| • failure to thrive and short stature | • Autism (as mentioned in objective 24) |

Neonatology

- | | |
|--|---------------------------------|
| • perinatal care | • low birth weight |
| • care in the labor room and resuscitation | • newborn feeding |
| • prematurity | • respiratory distress |
| • common transient phenomena | • apnea |
| • infections | • anemia and bleeding disorders |

- jaundice
- neurologic disorders
- renal disorders
- thermoregulation and its disorders
- gastrointestinal disorders
- malformations
- understanding of perinatal medicine

Nutrition

- maternal nutritional disorders; impact on fetal outcome
- infant feeding including complementary feeding
- protein energy malnutrition
- adolescent nutrition
- nutritional management of systemic illness (GI, hepatic, renal illness)
- nutrition for the low birth weight
- breast feeding
- vitamin and mineral deficiencies
- obesity
- parenteral and enteral nutrition

Cardiovascular

- congenital heart diseases (cyanotic and acyanotic)
- infective endocarditis
- disease of myocardium (cardiomyopathy, myocarditis)
- hyperlipidemia in children
- rheumatic fever and rheumatic heart disease
- arrhythmia
- diseases of pericardium
- systemic hypertension

Respiratory

- congenital and acquired disorders of nose tonsils and adenoids
- congenital anomalies of lower respiratory tract
- foreign body in larynx trachea and bronchus
- subglottic stenosis (acute, chronic)
- bronchial asthma
- acute pneumonia, bronchiolitis
- recurrent, interstitial pneumonia
- atelectasis
- pleural effusion
- infections of upper respiratory tract
- obstructive sleep apnea
- acute upper airway obstruction
- trauma to larynx
- neoplasm of larynx and trachea
- bronchiolitis
- aspiration pneumonia, GER
- suppurative lung disease
- lung cysts, mediastinal mass

Gastrointestinal and liver disease

- disease of oral cavity esophagus
- peptic ulcer disease
- intestinal obstruction disorders
- disorders of deglutition and
- congenital pyloric stenosis
- acute and chronic pancreatic

- malabsorption syndrome
- irritable bowel syndrome
- Hirschsprung disease
- hepatitis
- chronic liver disease
- metabolic diseases of liver

- acute and chronic diarrhea
- inflammatory bowel disease
- anorectal malformations
- hepatic failure
- Budd-Chiari syndrome
- cirrhosis and portal hypertension

Nephrologic and Urologic disorders

- acute and chronic glomerulonephritis
- hemolytic uremic syndrome
- VUR and renal scarring
- renal tubular disorders
dysfunction
- congenital and hereditary renal disorders
- posterior urethral valves
- undescended testis, hernia, hydrocoele

- xanthema syndrome
- urinary tract infection
- involvement in systemic diseases
- neurogenic bladder, voiding
- renal and bladder stones
- hydronephrosis
- Wilms tumor

Neurologic disorders

- seizure and non-seizure paroxysmal events
- meningitis, encephalitis
- febrile encephalopathies
- neurocysticercosis and other neuroinfestations
- SSPE
- neurometabolic disorders
- neuromuscular disorders
- learning disabilities
- acute flaccid paralysis and AFP surveillance
- movement disorders

- epilepsy, epileptic syndromes
- brain abscess
- Guillain-Barre syndrome
- HIV encephalopathy
- cerebral palsy
- neurodegenerative disorders
- mental retardation
- muscular dystrophies
- malformations
- Tumors

Hematology and Oncology

- deficiency anemias
- aplastic anemia
- thrombocytopenia
- blood component therapy
- bone marrow transplant/stem cell transplant
- myelodysplastic syndrome
- neuroblastoma

- hemolytic anemias
- pancytopenia
- disorders of hemostasis
- transfusion related infections
- acute and chronic leukemia
- Lymphoma
- hypercoagulable states

Endocrinology

- hypopituitarism/hyperpituitarism
- pubertal disorders

- diabetes insipidus
- hypo – and hyper-thyroidism

- adrenal insufficiency
- adrenogenital syndromes
- hypoglycemia
- gonadal dysfunction and intersexuality

- Cushing's syndrome
- diabetes mellitus
- short stature
- obesity

Infections

- bacterial (including tuberculosis)
- fungal
- rickettsial
- protozoal and parasitic
- control of epidemics and infection prevention

- viral (including HIV)
- parasitic
- mycoplasma
- nosocomial infections
- safe disposal of infective material

Emergency and Critical Care

- emergency care of shock
- respiratory failure
- status epilepticus
- fluid and electrolyte disturbances
- poisoning
- scorpion and snake bites

- cardio-respiratory arrest
- acute renal failure
- acute severe asthma
- acid-base disturbances
- accidents

Immunology and Rheumatology

- arthritis (acute and chronic)
- immunodeficiency syndromes

- vasculitides
- systemic lupus erythematosus

ENT

- acute and chronic otitis media
- post-diphtheritic palatal palsy
- allergic rhinitis/sinusitis

- hearing loss
- acute/chronic tonsillitis/adenoids
- foreign body

Skin Diseases

- exanthematous illnesses
- pigment disorders
- infections
- atopic, seborrheic dermatitis
- alopecia

- vascular lesions
- vesicobullous disorders
- Steven-Johnson syndrome
- drug rash
- ichthyosis

Eye problems

- refraction and accommodation
- cataract
- strabismus

- partial/total loss of vision
- night blindness
- conjunctival and corneal disorders

- disorders of retina, including tumors

Behavioral and Developmental disorders

- rumination, pica
- sleep disorders
- breath holding spells
- mood disorders
- attention deficit hyperactivity disorders
- enuresis, encopresis
- habit disorders
- anxiety disorders
- temper tantrums
- autism (as mentioned in objective 24)

Social/Community Paediatrics

- national health programs related to child health
- Vaccines: constituents, efficacy, storage, contraindications and adverse reactions
- rationale and methodology of pulse polio immunization
- child labor, abuse, neglect
- disability and rehabilitation
- National policy of child health and population
- Principles of prevention, control of infections (food, water, soil, vector borne)
- Investigation of an epidemic
- IMNCI
- adoption
- rights of the child
- juvenile delinquency

Orthopaedics

- major congenital orthopedic deformities
- common bone tumors
- bone and joint infections

Approach to clinical problems

Growth and development

- precocious and delayed puberty
- impaired learning
- developmental delay

Neonatology

- low birth weight newborn
- sick newborn

Nutrition

- lactation management and complementary feeding
- failure to thrive
- protein energy malnutrition (underweight, wasting, stunting) and micronutrient deficiencies

Cardiovascular

- Murmur
- cyanosis

- congestive heart failure
- arrhythmia

GIT and Liver

- Acute diarrhea
- abdominal pain and distension
- vomiting
- gastrointestinal bleeding
- hepatosplenomegaly

Respiratory

- Cough/chronic cough
- wheezy child

Infections

- acute onset pyrexia
- recurrent infections
- nosocomial infections

Renal

- Hematuria/dysuria
- voiding dysfunctions
- hypertension

Hematology and Oncology

- anemia

Neurology

- limping child
- paraplegia, quadriplegia
- macrocephaly and microcephaly
- acute flaccid paralysis

Endocrine

- thyroid swelling
- obesity

Miscellaneous

- skin rash
- epistaxis
- arthralgia, arthritis

- systemic hypertension
- shock

- persistent and chronic diarrhea
- ascites
- constipation
- jaundice
- hepatic failure and encephalopathy

- hemoptysis
- respiratory distress

- prolonged pyrexia with and without localizing signs
- fever with xanthema

- bladder/bowel incontinence
- renal failure (acute and chronic)

- bleeding

- convulsions
- cerebral palsy
- floppy infant
- headache

- ambiguous genitalia
- short stature

- lymphadenopathy
- proptosis

MD-DERMATOLOGY, VENEREOLOGY AND LEPROSY

PROGRAMME OUTCOME

SUBJECT SPECIFIC OBJECTIVES

At the end of 3 years of post graduate training in Dermatology, Venereology & Leprosy:

- Student should have knowledge of basic sciences (Anatomy, Physiology, Biochemistry, Microbiology, Pathology and Pharmacology) as applied to dermatology. The student should acquire in-depth knowledge of his subject including recent advances. The student should be fully conversant with the bedside procedures (diagnostic and therapeutic) and having knowledge of latest diagnostics and therapeutics available.
- Student should have acquired practical and procedural skills related to the subject.
- Critically evaluate, initiate investigation and clinically manage cases in Dermatology, Venereology and Leprosy with the help of relevant investigations.

- Should plan and advise measures for the prevention and rehabilitation of patients with various dermatological conditions.
- Able to ensure the implementation of National Health Programmes, particularly in sexually transmitted diseases (STD) and leprosy.
- Acquire training skills in research methodology, professionalism, attitude and communication skills, as below:
 - Student must know basic concepts of research methodology, plan a research project, consult library and online resources, has basic knowledge of statistics and can evaluate published studies.
 - Should be able to practice the specialty of dermatology ethically.
 - Recognize the health needs of patients and carry out professional obligations in keeping with principles of National Health Policy and professional ethics.
- Teaching skills in the subject
 - Student should learn the basic methodology of teaching and develop competence in teaching medical/paramedical students.
- Should have acquired Problem Solving skills

SUBJECT SPECIFIC COMPETENCIES

By the end of the course, the student should have acquired knowledge (cognitive domain), professionalism (affective domain) and skills (psychomotor domain) as given below:

A. Cognitive domain

At the end of the course, the student should have acquired following theoretical competencies:

- Describe structure, functions and development of human skin.
- Describe ultrastructural aspects of epidermis, epidermal appendages, dermo-epidermal junction, dermis, and sub-cutis.
- Describe basic pathologic patterns and reactions of skin.
- Demonstrate the knowledge of common laboratory stains and procedures used in the histopathologic diagnosis of skin diseases and special techniques such as immunofluorescence, immunoperoxidase and other related techniques.
- Describe the basics of cutaneous bacteriology, mycology, virology, parasitology and host resistance.
- Describe papulosquamous and vesiculobullous disorders.
- Describe disorders of epidermal appendages and related disorders.
- Describe inflammatory and neoplastic disorders of dermis.
- Describe skin lesions in nutritional, metabolic and heritable disorders.

- Describe pharmacokinetics and principles of topical and systemic therapy.
- Describe drug reaction, its diagnosis and management.
- Describe cutaneous manifestations of systemic disorders.
- Describe anatomy of male and female genitalia, epidemiological transmission, clinical aspects and management of STDs and HIV.
- Describe clinical features, reactions, treatment and rehabilitation in leprosy.
- Describe etiology, pathophysiology, principles of diagnosis and management of common problems in dermatology including emergencies in adults and children.
- Describe indications and methods for fluid and electrolyte replacement therapy including blood transfusion in dermatological conditions.
- Describe common dermatological malignancies in the country and their management including prevention.
- Should be expert in evaluation of ECG, chest X-ray (CXR), biochemical, haematology and immunology reports related to dermatology.
- Acquire knowledge of common laboratory stains and procedures used in the histopathologic diagnosis of skin diseases and special techniques such as immuno-fluorescence, immuno-peroxidase and other related techniques.
- Acquire knowledge of the basics of laser operation and precautions which needs to be taken.
- Demonstrate competence in basic concepts of research methodology and interpretation of data in medical literature/publications.
- Skilled as a self-directed learner, recognize continuing educational needs; use appropriate learning resources and critically analyze relevant published literature in order to practice evidence-based dermatology;
- Should also have a broad idea how to approach an uncommon dermatological disease.

B. Affective Domain

At the end of the course, the student should have acquired the following attitudinal competencies:

- Demonstrate self-awareness and personal development in routine conduct.
- **Behavior and Emotional Stability:** Dependable, disciplined, dedicated, stable in emergency situations and shows positive approach.
- **Motivation and Initiative:** Is innovative, enterprising, does not shirk duties or leave any work pending and motivates team members.
- **Honesty and Integrity:** Is truthful, admits mistakes, does not cook up information, has ethical conduct and exhibits good moral values.
- **Interpersonal Skills and Leadership Quality:** Has compassionate attitude towards patients and attendants, gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

- Should be able to maintain confidentiality with regards to history, physical examination and management of patients.
- Identify social, economic, environmental, biological and emotional determinants of patients, and institute diagnostic, therapeutic, rehabilitative, preventive and promotive measures to provide holistic care to patients at individual and community level against skin, venereal disease and leprosy.
- Recognize the emotional and behavioral characteristics of patients and keep these fundamental attributes in focus while dealing with them.
- Demonstrate empathy and humane approach towards patients and their families and respect their sensibilities.
- Demonstrate communication skills of a high order in explaining management and prognosis, providing counseling and giving health education messages to patients, families and communities.
- Organize and supervise the desired managerial and leadership skills.
- Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
- Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.

C. Psychomotor Domain

A student at the end of training of 3 years of MD programme, must acquire the following practical skills:

- General medical skills as learnt in MBBS to be maintained:
 - Should be able to provide basic life support (BLS).
 - Should be expert in blood pressure measurement, intravenous access, blood sampling, fluid electrolytes therapy, pleural and cerebrospinal; fluid (CSF) fluid examination.
 - Should be able to provide basic and advanced life-saving support services in emergency situations.
 - Should be able to undertake complete monitoring of the patient and identify social, economic, environmental and emotional determinants in a given case and take them into account for planning therapeutic measures.
- Recognize conditions that may be outside the area of his specialty/competence and refer them to the proper specialist.

Dermatology, Venereology and Leprosy, HIV/AIDS Skills

The student should:

- Acquire skills in history taking, physical examination, diagnosis and management of patients in dermatology, venereology and leprosy.
- Be able to identify, classify and differentiate cutaneous findings in dermatological terms in a systematic way.
- Be able to perform systemic examination (chest, cardiac, abdomen, neurological, genitals, oral, eye and gynaecological examination) relevant to dermatologic condition.
- Be competent to manage dermatologic emergencies like angioedema, toxic epidermal necrolysis (TEN), Stevens-Johnson syndrome (SJS), pemphigus, drug reaction and necrotic erythema nodosum leprosum (ENL).
- Be able to plan and deliver comprehensive treatment for diseases using principles of rational drug therapy.
- Be able to plan and advice measures for the prevention of infectious disease.
- Be able to plan rehabilitation of patient suffering from chronic illness and disability and those with special needs like leprosy.
- Demonstrate skills in documentation of case details and of morbidity/mortality data relevant to the assigned situation.

Laboratory Skills

The student:

- Should be able to perform common laboratory procedures like potassium hydroxide (KOH) mount, Gram stain, Giemsa stain, acid fast bacilli (AFB) stain, Woods lamp examination, stains, culture media etc. related to the cutaneous diagnosis independently.
- Should be able to order relevant investigations and interpret them to reach to a diagnosis.
- Should be familiar with other recent investigations.

Dermatopathology - Student should be competent enough to:

- To interpret histopathology of common skin diseases.
- To diagnose common skin diseases by examining slides under microscope.

Surgery in dermatology

At the end of training following skills should be performed independently by the student:

1. Should able to give incisions, take stitches and sutures.
2. Should be trained in taking skin biopsy and nail biopsy.
3. Should be able to perform chemical peels, manual dermabrasion, skin punch grafting and wound dressing independently.

4. Should be able to perform cryosurgery, nail surgery and acne surgery.
5. Able to perform chemical cauterization, cryotherapy, patch and photopatch test, slit smears and tissue smears.

Venereology

1. Should be competent in the clinical approach to the patient of STDs and HIV/AIDS.
2. Should be able to interpret the histopathological diagnosis including laboratory aids related with venereology.
3. Able to perform dark ground illumination, gram stain, Bubo aspiration and tissue smear.
4. Able to manage the patient according to syndromic approach for treatment of STDs.

Leprosy

The student should be:

1. Able to diagnose and approach the case of leprosy.
2. Perform AFB smear.
3. Able to manage cases of lepra reaction.
4. Identify, judge and decide when to refer the patients at appropriate level for surgery or rehabilitation. Should be able to manage pediatric cases with skin diseases.

COURSES OUTCOMES

Syllabus

Course contents

Topics related to allied basic sciences

- The structure, functions and development of human skin.
- Ultrastructural aspects of epidermis, epidermal appendages, dermo-epidermal junction, dermis, and sub-cutis.
- Immunology, molecular biology and genetics in relation to the skin.
- Epidermal cell kinetics and keratinization.
- Lipids of epidermis and sebaceous glands.
- Percutaneous absorption.
- Skin as an organ of protection and thermoregulation.
- Biology of eccrine and apocrine sweat glands.
- Biology of melanocytes and melanin formation.
- Biology of hair follicles, sebaceous glands and nails.
- Epidermal proteins.
- Dermal connective tissue: collagen, elastin, reticulin, basement membrane and ground substance.
- Metabolism of carbohydrates, proteins, fats and steroids by the skin.
- Cutaneous vasculature and vascular reactions.

- Mechanism of cutaneous wound healing.
- Cellular and molecular biology of cutaneous inflammation and arachidonic acid metabolism.
- Immunologic aspects of epidermis.
- Human leukocyte antigen (HLA) system.
- Immunoglobulins.
- Cytokines and chemokines.
- Lymphocytes, neutrophils, eosinophils, basophils and mast cells.
- Complement system.
- Hypersensitivity and allergy.
- Cutaneous carcinogenesis (chemical, viral and radiation).
- Basics of cutaneous bacteriology, mycology, virology, parasitology and host resistance.
- Common laboratory procedures, stains, culture media etc. related to the cutaneous diagnosis.
- Basic pathologic patterns and reactions of skin.
- Common laboratory stains and procedures used in the histopathologic diagnosis of skin diseases and special techniques such as immunofluorescence, immunoperoxidase and other related techniques.

Clinical dermatology

- Epidemiology of cutaneous disease.
- Psychologic aspects of skin disease and psycho-cutaneous disorders.
- Pathophysiology and clinical aspects of pruritus.

Papulosquamous diseases

- Psoriasis, pityriasis rubra pilaris, pityriasis rosea.
- Parapsoriasis, lichen planus, lichen nitidus.
- Palmo-plantar keratodermas, Darier's disease, porokeratosis.
- Ichthyoses and ichthyosiform dermatoses.
- Kyrle's disease and other perforating disorders.

Vesiculo - bullous disorders

- Erythema multiforme, Stevens-Johnson syndrome, Toxic epidermal necrolysis.
- Bullous pemphigoid, Pemphigus.
- Chronic bullous disease of childhood.
- Herpes gestationis (pemphigoid gestationis).
- Hereditary epidermolysis bullosa.
- Epidermolysis bullosa acquisita.
- Dermatitis herpetiformis.
- Familial benign pemphigus.

- Subcorneal pustular dermatoses.
- Pustular eruptions of palms and soles.

Disorders of epidermal appendages and related disorders

- Disorders of hair and nails.
- Disorders of sebaceous glands.
- Rosacea, Perioral dermatitis, acne.
- Disorders of eccrine and apocrine sweat glands.
- Follicular syndromes with inflammation and atrophy.

Epidermal and appendageal tumours

- Precancerous lesions, squamous cell carcinoma and basal cell carcinoma
- Keratoacanthoma, benign epithelial tumours, appendageal tumours
- Merkel cell carcinoma, Paget's disease

Disorders of melanocytes

- Disorders of pigmentation, albinism, benign neoplasia and hyperplasias of melanocytes, dysplastic melanocytic nevi, cutaneous malignant melanoma.

Inflammatory and neoplastic disorders of the dermis

- Acute febrile neutrophilic dermatosis (Sweet's syndrome)
- Erythema elevatum diutinum
- Cutaneous eosinophilic diseases
- Granuloma faciale
- Pyoderma gangrenosum
- Erythema annulare centrifugum and other figurate erythemas
- Granuloma annulare
- Malignant atrophic papulosis (Deigo's Disease)
- Neoplasms, pseudoneoplasms and hyperplasias of the dermis
- Vascular anomalies
- Kaposi's Sarcoma
- Anetoderma and other atrophic disorders of the skin
- Ainhum and pseudoainhum
- Neoplasias and hyperplasias of neural and muscular origin
- Elastosis perforans serpiginosa and reactive perforating collagenosis

Lymphomas, pseudolymphomas and related conditions

Disorders of subcutaneous tissue

- Panniculitis

- Lipodystrophy
- Neoplasms of the subcutaneous fat

Disorders of the mucocutaneous integument

- Biology and disorders of the oral mucosa
- Disorders of the anogenitalia of males and females

Cutaneous changes in disorders of altered reactivity

- Genetic immunodeficiency diseases
- Urticaria and Angioedema
- Disorders associated with complement abnormalities
- Graft-versus-host Disease
- Mucocutaneous manifestations in immunosuppressed host other than HIV-infection
- Contact dermatitis
- Auto-sensitization dermatitis
- Atopic dermatitis (atopic eczema)
- Nummular eczematous dermatitis
- Seborrhoeic dermatitis
- Vesicular palmoplantar eczema

Skin changes due to mechanical and physical factors

- Occupational skin disease
- Radiobiology of the skin
- Skin problems in amputee
- Sports dermatology
- Skin problems in war field
- Decubitus ulcers

Photomedicine, photobiology and photo immunology in relation to skin

- Acute and chronic effects of ultraviolet radiation and sun light on the skin
- Narrow-band ultraviolet B (NBUVB) therapy, phototherapy, photochemotherapy

Disorders due to drugs and chemical agents

- Cutaneous reactions to drugs
- Mucocutaneous complications of anti-neoplastic therapy
- Cutaneous manifestations of drug abuse

Dermatology and the ages of man

- Neonatal dermatological problems
- Pediatric and adolescent dermatological problems

- Ageing of skin
- Geriatric dermatological problems

Skin lesions in nutritional metabolic and heritable disorders

- Cutaneous changes in nutritional disease
- Acrodermatitis enteropathica and other zinc deficiency disorders
- Cutaneous changes in errors of amino acid metabolism: Tyrosinemia II, phenylketonuria, arginine succinic aciduria, and alkaptonuria
- Amyloidosis of the skin
- The porphyrias
- Xanthomatosis and lipoprotein disorders
- Fobry's Disease; galactosidase - a deficiency (Angiokeratoma corporis diffusum universale)
- Lipid proteinosis
- Cutaneous mineralisation and ossification
- Heritable disorders of connective tissue with skin changes
- Heritable disease with increased sensitivity to cellular injury
- Basal cell Naevus syndrome

Skin manifestations of hematologic disorders

- Skin changes in hematological disease
- Langerhans cell and other cutaneous histiocytoses
- The Mastocytosis syndrome

Skin manifestations of systemic disease

- The skin and disorders of the alimentary tract
- The hepatobiliary system and the skin
- Cutaneous changes in renal disorders, cardiovascular, pulmonary disorders and endocrinal disorders
- Skin changes and diseases in pregnancy
- Skin changes in the flushing disorders and the carcinoid syndrome

Skin manifestations of rheumatologic disease

- Lupus Erythematosus
- Dermatomyositis
- Scleroderma
- Systemic Necrotizing Arteritis
- Cutaneous Necrotising venulitis
- Cryoglobulinemia and Cryofibrinogenemia
- Relapsing Polychondritis
- Rheumatoid Arthritis, Rheumatic Fever and Gout

- Sjogren's syndrome
- Raynaud's phenomenon
- Reiter's syndrome
- Multicentric Reticulohistiocytosis

Cutaneous manifestations of disease in other organ systems

- Sarcoidosis of the skin
- Cutaneous manifestations of Internal Malignancy
- Acanthosis Nigricans
- Scleredema
- Papular Mucinosis
- Neurocutaneous disease
- Tuberous Sclerosis Complex
- The Neurofibromatosis
- Ataxia Telangiectasia
- Behcet's disease

Bacterial diseases with cutaneous involvement

- General considerations of bacterial diseases
- Pyodermas: Staphylococcus aureus, Streptococcus, and others
- Staphylococcal Scalded-Skin syndrome
- Soft Tissue Infections: Erysipelas, Cellulitis, Septicemia and Gangrenous Cellulitis
- Gram-Negative Coccal and bacillary infections
- Bartonellosis
- Miscellaneous bacterial infections with cutaneous manifestations
- Tuberculosis and other myopacterial infections
- Actinomycosis, Necardiosis, and Actinomycetoma
- Lyme Borreliosis
- Kawasaki Disease

Fungal diseases with cutaneous involvement

- Superficial fungal infection: Dermatophytosis, Tinea Nigra, Piedra
- Yeast Infections: Candidiasis, Pitryiasis (Tinea) Versicolor
- Deep Fungal Infections

Viral and ricketisial disease

- Viral Diseases: general consideration
- Rubella (German Measles)
- Measles
- Hand, Foot and Mouth Disease
- Herpangina

- Erythema Infectiosum and Parvovirus B 19 infection
- Herpes simplex
- Varicella and Herpes Zoster
- Cytomegalovirus Infection
- Epstein - Barr Virus Infections
- Human Herpes virus 6 & 7 infections and Exanthem subitum (Roseola Infantum or Sixth Disease)
- Smallpox and Complications of small pox vaccination
- Contagious Pustular Dermatitis, Contagious Ecthyma: Orf virus infection
- Milluscum Contagiosum
- Miller's Nodules
- Warts
- Human Retroviral Disease: Human T-Lymphotropic Virusviruses

Therapeutics

Topical therapy

- Pharmacokinetics principles intopical applications of drugs.
- Principles of topical therapy.

Topical agents

- Glucocorticoids, Acne therapies, Analgesics, Anesthetics, Anti-inflammatory, Anti hair loss, Anti-microbial, Anti-parasitic, Anti-perspirants, Anti-pruritic, Anti-viral, Astringents, Bleaching agents, Keratolytics, Psoriasis therapies, Wart therapies, Topical Retinoids, Topical Antibiotics, Topical Anti-fungal Agents, Sun-protective Agents, Keratolytic Agents, Topical Cytotoxic Agents, Cosmetics and Skin care in practice.

Systemic therapy

- Systemic glucocorticoids, Sulfones, Aminoquinolines, Cytotoxic and Antimetabolic Agents, Oral Retinoids, Antihistamines, Antibiotics, Antiviral Drugs, Oral Antifungal Agents, Immunosuppressive and Immunomodulatory drugs, Thalidomide, photo-chemotherapy and photo-therpay, electric cautery, cryotherapy, electrolysis, tattoeing, intra-lesional injections etc.

Surgery in dermatology

- Dermatologic Surgery: Introduction and Approach
- Skin Resurfacing: Chemical Peels
- Skin Resurfacing: Dermabrasion
- Skin Resurfacing: Laser
- Skin punch grafting
- Wound Dressings
- Cryosurgery

- Nail Surgery

Venereology

- Clinical approach to the patient of sexually transmitted disease
- Anatomy of male and female genitalia
- Epidemiological aspects of STDs
- Viral STDs including HIV, Herpes, Human Papilloma virus (HPV), Molluscum contagiosum, Espirito Santo virus (ESV) etc.
- Bacterial STD's: Syphilis, Gonorrhoea, Chancroid, Donovanosis
- Chlamydial infections: Lymphogranuloma venereum, urethritis, cervicitis, nongonococcal urethritis (NGU), non-specific vaginitis etc.
- Fungal: Candidiasis
- Protozoal: Trichomoniasis
- Ectoparasitic: Scabies, Pediculosis infestations.
- Syndromic management of STDs
- HIV/AIDS - Epidemiology, transmission, patient load, High risk groups, cutaneous manifestations of HIV, treatment of opportunistic infections, antiretroviral therapy, management of STDs in HIV positive cases
- STDs in reproduction health and Pediatrics
- STDs and HIV
- Prevention, counselling and education of different STDs including HIV
- National Control Programmes of STDs and HIV infection
- Medico-legal, social aspects of STDs including psychological and behavioural abnormalities in STD patients

Leprosy

- Approach to the patient with leprosy
- Epidemiological aspects
- Structure, biochemistry, microbiology of Mycobacterium leprae
- Animal models
- Pathogenesis
- Classification

- Immunology and molecular biological aspects
- Histopathology and diagnosis including laboratory aids
- Clinical features
- Reactions
- Systemic involvement (Ocular, bone, mucosa, testes and endocrine etc.)
- Pregnancy and leprosy
- HIV infection and leprosy

MS-GENERAL SURGERY

Program Outcomes

At the end of postgraduate training, the PG student shall be able to:

PO1: Diagnose and manage common surgical conditions (including emergencies)

PO2: Provide proper pre-operative and post-operative care for surgical patients

PO3: Counsel patients and their relatives regarding the need of a surgical procedure, its implications and related problems; obtain a proper informed consent for a surgical procedure

PO4: Identify cases requiring urgent surgical intervention / referral at the optimum time to appropriate centre

PO5: Decide upon priorities in cases of mass disasters

PO6: Deliver medico-legal and ethical responsibilities effectively

PO7: Formulate preventive and rehabilitative measures for surgical patients as and when necessary

PO8: Conduct a surgical audit periodically and maintain proper records

PO9: Update knowledge and newer techniques in the specialty

PO10: Demonstrate an aptitude for scientific writing, including critical appraisal of published literature

PO11: Plan a research project with defined evaluation outcomes

PO12: Demonstrate competency in teaching medical / paramedical students

PO13: Conduct himself / herself professionally, with integrity, accountability, responsibility and compassion for fellow beings, striving for excellence and continuous professional development

SUBJECT SPECIFIC COMPETENCIES

By the end of the course, the student should have acquired knowledge (cognitive domain), professionalism (affective domain) and skills (psychomotor domain) as given below:

A. Cognitive domain

- Demonstrate knowledge of applied aspects of basic sciences like applied anatomy, physiology, biochemistry, pathology, microbiology and pharmacology.
- Demonstrate knowledge of the bedside procedures and latest diagnostics and therapeutics available.
- Describe aetiology, pathophysiology, principles of diagnosis and management of common surgical problems including emergencies, in adults and children.
- Demonstrate the theoretical knowledge of general principles of surgery.
- Demonstrate the theoretical knowledge of systemic surgery including disaster management and recent advances.
- Demonstrate the theoretical knowledge to choose, and interpret appropriate diagnostic and therapeutic imaging including ultrasound, Mammogram, CT scan, MRI.
- Demonstrate the knowledge of ethics, medico-legal aspects, communication skills and leadership skills. The PG student should be able to provide professional services with empathy and humane approach.

B. Affective domain

- Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
- Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
- Develop communication skills to word reports, obtain a proper relevant history and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.
- Obtain informed consent for any examination/procedure and explain to the patient and attendants the disease and its prognosis with a humane approach.
- Provide appropriate care that is ethical, compassionate, responsive and cost effective and in conformation with statutory rules.

C. Psychomotor domain

- Perform a humane and thorough clinical examination including internal examinations and examinations of all organs/systems in adults and children
- Write a complete case record with all necessary details.
- Arrive at a logical working diagnosis / differential diagnosis after clinical examination.
- Order appropriate investigations keeping in mind their relevance (need based).
- Choose, perform and interpret appropriate imaging in trauma - ultrasound FAST (Focused Abdominal Sonography in Trauma).

- Perform minor operative procedures and common general surgical operations independently and the major procedures under guidance.
- Provide basic and advanced life saving support services in emergency situations
- Provide required immediate treatment and comprehensive treatment taking the help of specialist as required.
- Perform minimally invasive surgery in appropriate clinical settings. Must have undergone basic training in operative laparoscopy related to general and GI Surgery.
- Undertake complete patient monitoring including the preoperative and post operative care of the patient.
- Write a proper discharge summary with all relevant information.

COURSES OUTCOME Syllabus

Course Contents:

No limit can be fixed and no fixed number of topics can be prescribed as course contents. She/he is expected to know the subject in depth, however, emphasis should be on the diseases/health problems most prevalent in that area. Knowledge of recent advances and basic sciences as applicable to his/her specialty should get high priority. Competence in surgical skills commensurate with the specialty (actual hands - on training) must be ensured.

1. General topics:

A student should have fair knowledge of basic sciences (Anatomy, Physiology, Biochemistry, Microbiology, Pathology and Pharmacology) as applied to his specialty. Further, the student should acquire in-depth knowledge of his subject including recent advances and should be fully conversant with the bedside procedures (diagnostic and therapeutic) and having knowledge of latest diagnostics and therapeutics available.

1. History of medicine with special reference to ancient Indian texts
2. Health economics - basic terms, health insurance
3. Medical sociology, doctor-patient relationship, family adjustments in disease, organizational behavior, conflict resolution
4. Computers - record keeping, computer aided learning, virtual reality, robotics
5. Hazards in hospital and protection:
AIDS, hepatitis B, tuberculosis, radiation, psychological
6. Environment protection - bio-medical waste management
7. Surgical audit, evidence based surgical practice, quality assurance
8. Concept of essential drugs and rational use of drugs
9. Procurement of stores and material & personal management

10. Research methodology - library consultation, formulating research, selection of topic, writing thesis protocol, preparation of consent form from patients
11. Bio-medical statistics, clinical trials
12. Medical ethics
13. Consumer protection
14. Newer antibiotics
15. Problem of resistance.
16. Sepsis - SIRS
17. Nosocomial infection
18. Advances in imaging technologies
19. Disaster management, mass casualties, Triage
20. O.T. design, technologies, equipment
21. Critical care in surgical practice
22. Response to trauma
23. Wound healing
24. Fluid and electrolyte balance
25. Nutrition
26. Blood transfusion
27. Brain death
28. Cadaveric organ retrieval

1. Systemic Surgery

The student must acquire knowledge in the following important topics are but teaching should not be limited to these topics. A standard text-book may be followed, which will also identify the level of learning expected of the trainees.

- Wound healing including recent advances
- Asepsis, antisepsis, sterilization and universal precaution
- Surgical knots, sutures, drains, bandages and splints
- Surgical infections, causes of infections, prevention
- Common aerobic and anaerobic organisms and newer organisms causing infection including *Helicobacter Pylori*
- Tetanus, gas gangrene treatment & prevention
- Chronic specific infections TB, Filariasis
- Boils, cellulites, abscess, necrotizing fasciitis and synergistic infection
- Antibiotic therapy rationale including antibiotic prophylaxis, misuse, abuse
- Hospital acquired nosocomial infection causes and prevention including MRSA etc.
- HIV, AIDS and Hepatitis B & C, Universal precautions when dealing with patients suffering from these diseases
- Fluid and electrolyte balance including acid – base disturbance, consequences,

interpretation of blood gas analysis data and management

- Rhabdomyolysis and prevention of renal failure
- Shock (septicaemic, hypovolaemic, Neurogenic, anaphylactic), etiology, pathophysiology and management
- Blood and blood components, transfusion indication, contraindication, mismatch and prevention and management of complications of massive blood transfusion
- Common preoperative preparation (detailed preoperative workup, risk assessment according to the disease and general condition of the patient as per ASA grade) and detailed postoperative complications following major and minor surgical procedures
- Surgical aspects of diabetes mellitus particularly management of diabetic foot and gangrene, preoperative control of diabetes, consequences of hypo- and hyperglycaemia in a postoperative setting
- Consequences and management of bites and stings including snake, dog, human bites
- Mechanisms and management of missile, blast and gunshot injuries
- Organ transplantation: Basic principles including cadaver donation, related Human Organ Transplant Acts, ethical and medicolegal aspects.
- Nutritional support to surgical patients
- Common skin and subcutaneous condition
- Sinus and fistulae, pressure sores
- Acute arterial occlusion, diagnosis and initiate management
- Types of gangrene, Burger's disease and atherosclerosis
- Investigations in case of arterial obstruction, amputation, vascular injuries: basic principles and management
- Venous disorders: Varicose veins
- Diagnosis, principles of therapy, prevention of DVT: basic principles and management
- Lymphatic: Diagnosis and principles of management of lymphangitis and lymphedema
- Surgical management of Filariasis
- Burns: causes, prevention and management
- Wounds of scalp and its management
- Recognition, diagnosis and monitoring of patients with head injury, Glasgow coma scale
- Undergo advanced trauma and cardiac support course (certified) before appearing in final examination
- Recognition of acute cerebral compression, indication for referrals.
- Cleft lip and palate
- Leukoplakia, retention cysts, ulcers of tongue

- Oral malignancies
- Salivary gland neoplasms
- Branchial cyst, cystic hygroma
- Cervical lymphadenitis nonspecific and tuberculous, metastatic lymph nodes and lymphomas.
- Diagnosis and principles of management of goitre
- Thyroglossal cyst and fistula
- Thyrotoxicosis
- Thyroid neoplasms
- Management of solitary thyroid nodule
- Thoracic outlet syndrome
- Management of nipple discharge
- Breast abscess
- Clinical breast examination, breast self examination
- Screening and investigation of breast lump
- Concept of Single Stop Breast Clinic
- Cancer breast diagnosis, staging and multimodality management (common neoadjuvant and adjuvant and palliative chemotherapy protocols and indications of radiation and hormonal therapy, pathology and interpretation of Tumour Markers, breast cancer support groups and counseling)
- Recognition and treatment of pneumothorax, haemothorax
- Pulmonary embolism: Index of suspicion, prevention/recognition and treatment
- Flail chest, stove in chest
- Postoperative pulmonary complication
- Empyema thoracis
- Recognition of oesophageal atresia and principles of management
- Neoplasms of the lung including its prevention by tobacco control
- Cancer oesophagus: principles of management including importance of early detection and timely referral to specialist
- Achalasia cardia
- Gastro-esophageal reflux disease (GERD)
- Congenital hypertrophic pyloric stenosis
- Aetiopathogenesis, diagnosis and management of peptic ulcer including role of H. Pylori and its diagnosis and eradication
- Cancer stomach
- Signs and tests of liver dysfunction
- Amoebic liver abscess and its non-operative management
- Hydatid cyst and its medical and surgical management including laparoscopic management
- Portal hypertension, index of suspicion, symptoms and signs of liver failure and

timely referral to a specialist center

- Obstructive jaundice with emphasis on differentiating medical vs surgical Jaundice, algorithm of investigation, diagnosis and surgical treatment options
- Neoplasms of liver
- Rupture spleen
- Indications for splenectomy
- Clinical features, diagnosis, complications and principles of management of cholelithiasis and cholecystitis including laparoscopic cholecystectomy
- Management of bile duct stones including endoscopic, open and laparoscopic management
- Carcinoma gall bladder, incidental cancer gallbladder, index of suspicion and its staging and principles of management
- Choledochal cyst
- Acute pancreatitis both due to gallstones and alcohol
- Chronic pancreatitis
- Carcinoma pancreas
- Peritonitis: causes, recognition, diagnosis, complications and principles of management with knowledge of typhoid perforation, tuberculous peritonitis, postoperative peritonitis
- Abdominal pain types and causes with emphasis on diagnosing early intra-abdominal acute pathology requiring surgical intervention
- Intestinal amoebiasis and other worms manifestation (Ascariasis) and their surgical complications (Intestinal Obstruction, perforation, gastrointestinal bleeding, involvement of biliary tract)
- Abdominal tuberculosis both peritoneal and intestinal
- Intestinal obstruction
- **Appendix:** Diagnosis and management of acute appendicitis
- Appendicular lump and abscess

Colon

- Congenital disorders, Congenital megacolon
- Colitis infective / non infective
- Inflammatory bowel diseases
- Premalignant conditions of large bowel
- Ulcerative colitis
- Carcinoma colon
- Principles of management of types of colostomy

Rectum and Anal Canal:

- Congenital disorders, Anorectal anomalies
- Prolapse of rectum

- Carcinoma rectum
- Anal Canal: surgical anatomy, features and management of fissures, fistula - in – ano.
- Perianal and ischiorectal abscess
- Haemorrhoids – Non-operative outpatient procedures for the control of bleeding (Banding, cryotherapy, injection) operative options - open and closed haemorrhoidectomy and stapled haemorrhoidectomy
- Anal carcinoma
- Clinical features, diagnosis, complication and principles of management of inguinal hernia including laparoscopic repair
- Umbilical, femoral hernia and epigastric hernia
- Open and Laparoscopic repair of incisional/primary ventral hernia
- Urinary symptoms and investigations of urinary tract
- Diagnosis and principles of management of urolithiasis
- Lower Urinary tract symptoms or prostatism
- Benign prostatic hyperplasia; diagnosis and management
- Genital tuberculosis in male
- Phimosi and paraphimosi
- Carcinoma penis
- Diagnosis and principles of treatment of undescended testis
- Torsion testis
- Hydrocele, haematocele and pyocele Varicocele: Diagnosis (Medical Board for fitness)
- Varicocele: Diagnosis (Medical Board for fitness)
- Acute and chronic epididymo-orchitis
- Testicular tumours
- Principles of management of urethral injuries
- Management of soft tissue sarcoma
- Prosthetic materials used in surgical practice
- Telemedicine, teleproctoring and e-learning
- Communication skills

A student should be expert in good history taking, physical examination, providing basic life support and advanced cardiac life support, common procedures like FNAC, Biopsy, aspiration from serous cavities, lumbar puncture etc. The student should be able to choose the required investigations.

Clinical cases and Symptoms-based approach to the patient with:

1. Ulcers in oral cavity

2. Solitary nodule of the thyroid
3. Lymph node in the neck
4. Suspected breast lump
5. Benign breast disease
6. Acute abdominal pain
7. Blunt Trauma Abdomen
8. Gall stone disease
9. Dysphagia
10. Chronic abdominal pain
11. Epigastric mass
12. Right hypochondrium mass
13. Right iliac fossa mass
14. Renal mass
15. Inguino-scrotal swelling
16. Scrotal swelling
17. Gastric outlet obstruction
18. Upper gastrointestinal bleeding
19. Lower gastrointestinal bleeding
20. Anorectal symptoms
21. Acute intestinal obstruction
22. Obstructive jaundice
23. Acute retention of Urine
24. Bladder outlet obstruction
25. Haematuria
26. Peripheral vascular disease
27. Varicose veins
28. New born with developmental anomalies
29. Hydronephrosis , Pyonephrosis, perinephric abscess
30. Renal tuberculosis
31. Renal tumors
32. Carcinoma prostate
33. Genital tuberculosis in male

At the end of the course, post graduate students should be able to perform independently (including perioperative management) the following:

- Start IV lines and monitor infusions
- Start and monitor blood transfusion
- Venous cut-down
- Start and manage a C.V.P. line
- Conduct CPR (Cardiopulmonary resuscitation)

- Basic/ advance life support
- Endotracheal intubation
- Insert nasogastric tube
- Proctoscopy
- Urethral catheterisation
- Surgical management of wounds
- Biopsies including image guided
- Manage pneumothorax / pleural space collections
- Infiltration, surface and digital Nerve blocks
- Incise and drain superficial abscesses
- Control external hemorrhage
- Vasectomy (Preferably non-scalpel)
- Circumcision
- Surgery for hydrocele
- Surgery for hernia
- Surgery and Injection/banding of piles
- Management of all types of shock
- Assessment and management of burns
- Hemithyroidectomy
- Excision of thyroglossal cyst
- Excision Biopsy of Cervical Lymphnode
- Excision of benign breast lump
- Modified Radical mastectomy
- Axillary Lymphnode Biopsy
- Excision of gynaecomastia
- Excision of skin and subcutaneous swellings
- Split thickness skin graft
- Management of hernias
- Laparoscopic and open cholecystectomy
- Management of Liver abscess
- appendectomy
- Management of intestinal obstruction, small bowel resection, perforation and anastomosis
- Colostomy

The student must have observed or assisted (the list is illustrative) in the following:

- Hartmann's procedure for cancer rectum
- Splenectomy (emergency)
- Stomach perforation
- Varicose Vein surgery

- Craniotomy (Head Injury)
- Superficial parotidectomy
- Submandibular gland excision
- Soft tissue tumours including sarcoma
- Pancreaticoduodenal resection
- Hydatid cyst liver
- Pancreatic surgery
- Retroperitoneal operations

MS-ORTHOPAEDICS

SUBJECT SPECIFIC LEARNING OBJECTIVES

This will be dealt with under the following headings:

- Theoretical knowledge (Cognitive domain)
- Practical and clinical skills (psychomotor domain)
- Attitudes including communication skills (Affective domain)
- Writing thesis / Reviewing Research activities (Scholarly activity)
- Training in Research Methodology (Practice based learning, Evidence based practice)
- Professionalism
- Teaching skills

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive domain

At the end of the M.S. Orthopaedics programme, the post graduate student should be able to:

1. Demonstrate sufficient understanding of the basic sciences relevant to orthopaedic speciality through a problem based approach.
2. Describe the Principles of injury, its mechanism and mode, its clinical presentation, plan and interpret the appropriate investigations, and institute the management of musculoskeletally injured patient.

3. Identify and describe the surface anatomy and relationships within of the various bones, joints, ligaments, major arteries, veins and nerves of the musculoskeletal system of the spine, upper limb, lower limb and the pelvis, chest, abdomen and head & neck.
4. Define and describe the pathophysiology of shock (circulatory failure).
5. Define and describe the pathophysiology of Respiratory failure
6. Describe the principles and stages of bone and soft tissue healing
7. Understand and describe the metabolic, nutritional, endocrine, social impacts of trauma and critical illness.
8. Enumerate, classify and describe the various bony/soft tissue injuries affecting the axial and appendicular skeletal system in adults and children.
9. Describe the principles of internal and external fixation for stabilization of bone and joint injuries.
10. Describe the mechanism of homeostasis, fibrinolysis and methods to control haemorrhage
11. Describe the physiological coagulation cascade and its abnormalities
12. Describe the pharmacokinetics and dynamics of drug metabolism and excretion of analgesics, anti inflammatory, antibiotics, disease modifying agents and chemotherapeutic agents.
13. Understanding of biostatistics and research methodology
14. Describe the clinical presentation, plan and interpret investigations, institute management and prevention of the following disease conditions
 - a. Nutritional deficiency diseases affecting the bones and joints
 - b. Deposition arthropathies
 - c. Endocrine abnormalities of the musculoskeletal system
 - d. Metabolic abnormalities of the musculoskeletal system
 - e. Congenital anomalies of the musculoskeletal system
 - f. Developmental skeletal disorder of the musculoskeletal system
15. Describe the pathogenesis, clinical features plan and interpret investigations and institute the management in adults and children in
 - a. Tubercular infections of bone and joints (musculoskeletal system)
 - b. Pyogenic infections of musculoskeletal system
 - c. Mycotic infections of musculoskeletal system
 - d. Autoimmune disorders of the musculoskeletal system
 - e. Rheumatoid arthropathy, Ankylosing spondylitis, seronegative arthropathy
 - f. Osteoarthritis and spondylosis
16. Describe the pathogenesis, clinical presentation, plan and interpret investigations and institute appropriate treatment in the following conditions:
 - a. Post polio residual paralysis
 - b. Cerebral palsy
 - c. Muscular dystrophies and myopathies
 - d. Nerve Injuries
 - e. Entrapment neuropathies
17. Identify the diagnosis and describe management of musculoskeletal manifestation of AIDS and HIV infection

18. Describe the aetiopathogenesis, identify, plan and interpret investigation and institute the management of osteonecrosis of bones.
19. Identify situations requiring rehabilitation services and prescribe suitable orthotic and prosthetic appliances and act as a member of the team providing rehabilitation care
20. Identify a problem, prepare a research protocol, conduct a study, record observations, analyse data, interpret the results, discuss and disseminate the findings.
21. Identify and manage emergency situation in disorders of musculoskeletal system
22. Understanding of the basics of diagnostic imaging in orthopaedics like:
 - a. Plain x-ray
 - b. Ultrasonography
 - c. Computerised axial tomography
 - d. Magnetic resonance imaging
 - e. PET scan
 - f. Radio Isotope bone scan
 - g. Digital Subtraction Angiography (DSA)
 - h. Dual energy x-ray Absorptiometry
 - i. Arthrography
23. Describe the aetiopathogenesis, clinical presentation, Identification, Plan investigation and institute treatment for oncologic problems of musculoskeletal system both benign and malignancies, primary and secondary.
24. Understand the basics, principles of biomaterials and orthopaedic metallurgy
25. Describe the principles of normal and abnormal gait and understand the biomedical principles of posture and replacement surgeries.
26. Describe social, economic, environmental, biological and emotional determinants of health in a given patient with a musculoskeletal problem.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

Attitudes including Communication skills and Professionalism

a. Communication skills:

- Exhibits participation in honest, accurate health related information sharing in a sensitive and suitable manner
- Recognizes that being a good communicator is essential to practice effectively

- Exhibits effective and sensitive listening skills
 - Recognises the importance and timing of breaking bad news and knows how to communicate
 - Exhibits participation in discussion of emotional issues
 - Exhibits leadership in handling complex and advanced communication
 - Recognizes the importance of patient confidentiality and the conflict between confidentiality and disclosure
 - Able to establish rapport in therapeutic bonding with patients, relatives and other stakeholders through appropriate communication
 - Able to obtain comprehensive and relevant history from patients/relatives
 - Able to counsel patients on their condition and needs
- b. **Teamwork:** Seek cooperation. Coordination and communication among treating specialties and paramedical staff
- c. **Counseling of relatives:** regarding patients condition, seriousness, bereavement and counseling for organ donation in case of brain stem death
- d. **Leadership:** Trauma prevention, education of the public, paramedical and medical persons.
Advocacy: with the government and other agencies towards cause of trauma care
- e. **Ethics:** The Code of Medical Ethics as proposed by Medical Council of India will be learnt and observed.

C. Psychomotor domain

1. At the end of the first year of M.S. Orthopaedics programme, the student should be able to:

1. Elicit a clinical history from a patient, do a physical examination, document in a case record, order appropriate investigations and make a clinical diagnosis
2. Impart wound care where applicable
3. Apply all types of POP casts/slabs, splints and tractions as per need
4. Identify shock and provide resuscitation
5. Perform aspiration of joints and local infiltration of appropriate drugs
6. Perform appropriate wound debridement
7. Perform arthrotomy of knee joint
8. Perform incision and drainage of abscess
9. Perform split thickness skin grafting
10. Perform fasciotomes
11. Apply external fixators
12. Apply skeletal tractions including skull tongs
13. Triage a disaster situation and multiple trauma patients in an emergency room
14. Perform on bone models, interfragmentary compression screws, external fixation, Tension band wiring and Broad plating
15. Perform closed reduction of common dislocations like shoulder and common fractures like collar fracture, supracondylar fracture.

16. Perform on a cadaver standard surgical approaches to the musculo skeletal system

2. At the end of the second year of M.S. Orthopaedics course, the student should be able to:

1. Take an informed consent for standard orthopaedic procedures
2. Perform closed/open biopsies for lesions of bone, joints and soft tissues
3. Perform split thickness skin grafting and local flaps
4. Perform on bone models, internal fixation with k-wires, screws, plates. Dynamic hip/condylar screws/nailing.
5. Perform sequestrectomy and saucerisation
6. Perform arthrotomy of joints like hip/shoulder, ankle, elbow
7. Perform repair of open hand injuries including tendon repair
8. Perform arthodesis of small joints
9. Perform diagnostic arthroscopy on models and their patients
10. Perform carpal tunnel/tarsal tunnel release
11. Apply ilizarov external fixator
12. Perform soft tissue releases in contractures, tendon lengthening and correction of deformities
13. Perform amputations at different levels
14. Perform corrective surgeries for CTEV, DDH, perthes/ skeletal dysplasia

3. At the end of the third year of M.S. Orthopaedics programme, the student should be able to:

1. Assist in the surgical management of polytrauma patient
2. Assist in Arthroplasty surgeries of hip, knee, shoulder and the ankle
3. Assist in spinal decompressions and spinal stabilizations
4. Assist in operative arthroscopy of various joints
5. Assist /perform arthrodesis of major joints like hip, knee, shoulder, elbow
6. Assist in corrective osteotomies around the hip, pelvis, knee, elbow, finger and toes
7. Assist in surgical operations on benign and malignant musculoskeletal tumour including radical excision and custom prosthesis replacement.
8. Assist in open reduction and internal fixations of complex fractures of acetabular, pelvis, IPSI lateral floating knee/elbow injuries, shoulder girdle and hand
9. Assist in spinal deformity corrections
10. Independently perform closed/open reduction and internal fixation with DCP, LCP, intrameduallary nailing, LRS
11. Assist in limb lengthening procedures
12. Assist in Revision surgeries
13. Provide pre and post OP care
14. Perform all clinical skills as related to the speciality.

COURSE OUTCOME

Syllabus

Course contents:

1. Basic Sciences

- Anatomy and function of joints
- Bone structure and function
- Growth factors and fracture healing
- Cartilage structure and function
- Structure and function of muscles and tendons
- Tendon structure and function
- Metallurgy in Orthopaedics
- Stem Cells in Orthopaedic Surgery
- Gene Therapy in Orthopaedics

2. Diagnostic Imaging in Orthopaedics

(Should know the interpretation and Clinical Correlation of the following): -

- Digital Subtraction Angiography (DSA)
- MRI and CT in Orthopaedics
- Musculoskeletal USG
- PET Scan
- Radio-isotope bone scan

3. Metabolic Bone Diseases

- Rickets and Osteomalacia
- Osteoporosis
- Scurvy
- Mucopolysaccharidoses
- Fluorosis
- Osteopetrosis

4. Endocrine Disorders

- Hyperparathyroidism
- Gigantism, Acromegaly

5. Bone and Joint Infections

- Pyogenic Haematogenous Osteomyelitis - Acute and Chronic
- Septic arthritis
- Fungal infections
- Miscellaneous infections
- Gonococcal arthritis

- Bone and joint brucellosis
- AIDS and the Orthopaedic Surgeon (universal precautions)
- Musculoskeletal Manifestations of AIDS
- Pott's spine
- Tubercular synovitis and arthritis of all major joints

6. Poliomyelitis

- General considerations
- Polio Lower limb and spine
- Management of Post Polio Residual Palsy (PPRP)

7. Orthopaedic Neurology

- Cerebral Palsy
- Myopathies

8. Peripheral Nerve Injuries

- Traumatic
- Entrapment Neuropathies

9. Diseases of Joints

- Osteoarthritis
- Calcium Pyrophosphate Dihydrate (CPPD), Gout
- Collagen diseases

10. Systemic Complications in Orthopaedics

- Shock
- Crush syndrome
- Disseminated Intravascular Coagulation (DIC)
- Acute Respiratory Distress Syndrome (ARDS)

11. Bone Tumors

- Benign bone tumors
- Malignant bone tumors
- Tumor like conditions
- Metastatic bone Tumors

12. Miscellaneous Diseases

- Diseases of muscles
- Fibrous Dysplasia
- Unclassified diseases of bone
- Paget's disease

- Peripheral vascular disease
- Orthopaedic manifestations of bleeding disorders

13. Regional Orthopaedic Conditions of Adults and Children

- The spine
- The shoulder
- The elbow
- The hand
- The wrist
- The hip
- The knee
- The foot and ankle
- The pelvis

14. Biomaterials

- Orthopaedic metallurgy
- Bio-degradable implants in Orthopaedics
- Bone substitutes
- Bone Banking

15. Fracture and Fracture-Dislocations

General considerations

- Definitions, types, grades, patterns and complications
- Pathology of fractures and fracture healing
- Clinical and Radiological features of fractures and dislocations
- General principles of fracture treatment
- Recent advances in internal fixation of fractures
- Locking plate osteosyntheses
- Less Invasive Stabilisation System (LISS)
- Ilizarov technique
- Bone grafting and bone graft substitutes
- Open fractures and soft tissue coverage in the lower extremity
- Compartment syndrome
- Fractures of the upper extremity and shoulder girdle
- Fractures of the lower extremity
- Fractures of the hip and pelvis
- Malunited fractures
- Delayed union and non union of fractures
- Fractures/dislocations and fracture - dislocations of spine

16. Dislocations and Subluxations

- Acute dislocations
- Old unreduced dislocations

- Recurrent dislocations

17. Traumatic Disorders of Joints (Sports Injuries)

- Ankle injuries
- Knee injuries
- Shoulder and elbow injuries
- Wrist and hand injuries

18. Arthrodesis

- Arthrodesis of lower extremity and hip
- Arthrodesis of upper extremity
- Arthrodesis of spine

19. Arthroplasty

- Biomechanics of joints and replacement of the following joints.
- Knee
- Ankle
- Shoulder
- Elbow

20. Minimally Invasive Surgery (MIS)

Arthroscopy

- General principles of Arthroscopy
- Arthroscopy of knee and ankle
- Arthroscopy of shoulder and elbow

21. Amputations and Disarticulations

- Amputations and disarticulations in the lower limb
- Amputations and disarticulations in the upper limb

22. Rehabilitation - Prosthetics and Orthotics

23. Pediatric orthopaedics:

- Fractures and dislocations in children
- Perthes' disease
- Slipped capital femoral epiphysis
- Congenital Dislocation of Hip (CDH)
- Neuromuscular disorders

24. Spine

a) **Spinal trauma:** diagnosis and management including various types of fixations

- i. Rehabilitation of paraplegics/quadruplegics
- ii. Management of a paralyzed bladder
- iii. Prevention of bed sores and management of established bed sores

- iv. Exercise programme and Activities of Daily Living (ADL)
- v. Psychosexual counseling

b) Degenerative disorders of the spine

- i. Prolapsed Inter Vertebral Disc (PIVD)
- ii. Lumbar Canal Stenosis (LCS)
- iii. Spondylolysis/Spondylolisthesis
- iv. Lumbar Spondylosis
- v. Ankylosing Spondylitis
- vi. Spinal fusion: various types and their indications.

25. Triage, Disaster Management, BTLS and ATLS

26. Recent advances in orthopaedics

- Autologous chondrocyte implantation
- Mosaicplasty
- Video assisted Thoracoscopy (VATS)
- Endoscopic spine surgery
- Metal on metal arthroplasty of hip
- Surface replacements of joints
- Microsurgical techniques in Orthopaedics
- Designing a modern orthopaedic operation theatre
 - Sterilization
 - Theatre Discipline
 - Laminar air flow
 - Modular OTs

MS-OTORHINOLARYNGOLOGY

Program Outcomes

At the end of postgraduate training the student should be able to:

- PO1. Practice his specialty ethically keeping in mind the requirement of the patient, community and people at large.
- PO2. Demonstrate sufficient understanding of basic sciences related to his specialty and be able to integrate such knowledge in his Clinical practice.
- PO3. Diagnose and manage majority of conditions in his specialty (clinically and with the help of relevant investigations)
- PO4. Plan and advise measures for the promotive, preventive, curative and rehabilitative aspects of health and diseases in the specialty of ENT.
- PO5. Should be able to demonstrate his cognitive skills in the field of ENT and its ancillary branches during the formative and summative evaluation processes.
- PO6. Play the assigned role in the implementation of National Health Programs
- PO7. Demonstrate competence in basic concepts of research methodology and writing thesis and research papers.
- PO8. Develop good learning, communication and teaching skills.
- PO9. Demonstrate sufficient understanding of basic sciences and the clinical applications related to the specialty to be able to integrate this knowledge into Clinical practice. Acquire in-depth knowledge in the subject including recent advances.
- PO10. Demonstrate that he is fully conversant with the latest diagnostics & therapeutics available

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive Domain

At the end of training, the student should be able to demonstrate ability to practically apply knowledge gained during training period. This would include the following:

Basic Sciences related to Otolaryngology

- Physiology- Mechanism of perception of smell and taste, mechanism of breathing and voice production, lacrimation, deglutition and salivation. Functional tests of the nose and paranasal sinuses, mechanism of cough and sneezing.
- Physics of sound, theories of hearing, mechanism of perception of sound and speech production, physiology of equilibrium and cerebral function. Physiology of brain in connection with hearing, speech, smell and phonation. Audiologic tests like audiometry, impedance, evoked potentials, OAE, Speech audiometry.
- Physiology of larynx, tracheobronchial tree and oesophagus - Histology of mucous membranes, internal ear and other associated organs and structures, nose, PNS NPx, Larynx, Tracheo-Bronchial tree, Lymphoepithelial system. Mechanism of immune system/immunology and genetics.
- Anatomy-Embryogenesis of ear, nose and throat including palate and the larynx, Oesophagus, trachea and lungs, tongue, salivary gland Head and Neck and skull base etc.
- Parapharyngeal spaces in the neck including connective tissue barriers of larynx.
- Applied anatomy of the skull bones, accessory sinuses, external, middle and inner ears, nose, PNS, nasopharynx, meninges, brain, pharynx, larynx, trachea and bronchi, lungs, pleurae, oesophagus and the mediastinum.
- Anatomy of all cranial nerves with their functions.

Principles and Practices of Otolaryngology, Audiology and Speech Pathology

- Clinical Methodology as applied to ORL HN diseases in adult and children and the accessory sinuses, diagnosis and surgical treatment of diseases of nose, throat and ear in adult and children. Prevention and treatment, infectious diseases of Otolaryngology and Head Neck region. Circulatory and nervous disturbances of the nose, throat and ear and their effects on other organs of the body. Deformities, injuries sinus infections, polyps and the tumors of the nose, and paranasal sinuses.
- Examination of the ear, deafness and allied diseases, complications of diseases of the ear. Injuries, tumors, nervous and circulatory neurological disturbances of the ear. Diagnosis and treatment of tinnitus and vertigo. Diagnosis and rehabilitation of the Hearing handicapped including, dispensing of hearing aid other vibrotatile aids.
 - Surgical pathology of Otolaryngology and Head Neck region.
 - Basic knowledge of anaesthesia as related to ENT.
 - Examination of diseases of children (Paediatric ORL) in connection with throat and larynx. Neurological and vascular disturbances. Congenital and neonatal stridor.
 - Pathology of various diseases of the larynx and throat, tracheo-bronchial tree and their causative organisms.

- Indications and various techniques of direct laryngoscopy, nasal endoscopy. Bronchoscopy and oesophagoscopy, including microlaryngoscopic procedures.
- Reading of radiograms, scans, audiograms, nystagmograms and tympanograms in connection with ENT diseases/disorders.
- Special apparatus for the diagnosis and treatment of the diseases of ear, nose and throat including audiometer, BERA, Speech analyser etc.

Recent advances in Otolaryngology and Head Neck surgery

- Recent developments in the diagnosis, pathogenesis and treatment of the ENT diseases
- The knowledge of the frontiers of the oto-laryngology and lateral skull base surgery
- Rhinoplasty, endoscopic sinus surgery, and anterior cranial fossa surgery
- Knowledge of LASERS and fibre optics
- Other methods of managing Hearing loss
- Implantable hearing aids cochlear implants
- Phonosurgery
- Etiology and Managements of sleep apnoea/snoring
- Hypophysectomy and optic nerve decompressions
- Immunotherapy and modalities of the gene therapy
- Newer techniques for Radiotherapy including, use of gamma knife for treatment of Intracranial tumors and other malignancy
- Chemotherapy of cancer

General Surgical Principles and Head-Neck Surgery

- General Surgery, Head and Neck oncology, and Medicine as applicable to the ENT disorders/diseases. Surgery of congenital deformities of nose, ear (Pinna) and trachea/oesophagus etc.
- Radiology, Imaging – computed tomography and magnetic resonance imaging, (MRI) and intervention radiology and angiography as related to ENT
- General Pathologic aspects such as wound healing and also pathology and Pathogenesis of ENT diseases, Pharmacology, molecular biology, genetics, cytology, haematology, and immunology as applicable to otolaryngology
- General Principles of faciomaxillary traumatology and neck injury
- Plastic Surgery as applicable to Otolaryngology

B. Affective Domain

1. The student will show integrity, accountability, respect, compassion and dedicated patient care. The student will demonstrate a commitment to excellence and continuous professional development.
2. The student should demonstrate a commitment to ethical principles relating to providing patient care, confidentiality of patient information and informed consent.
3. The student should show sensitivity and responsiveness to patients' culture, age, gender and disabilities.
4. The student should be able to choose the required investigations to enhance the attitude, communicative skills, including dealing with patient's relatives with the required empathy, adapt to changing trends in education, learning methods and evolving new diagnostic and therapeutic techniques in the subject of ENT.

C. Psychomotor Domain

By the end of the training, a student should be able to demonstrate his skills in:

- Taking a good history and demonstrating good examination techniques.
- arrive at a logical working diagnosis, differential diagnosis after clinical examination and order appropriate investigations keeping in mind their relevance (need based) and thereby provide appropriate care that is ethical, compassionate, responsive and cost effective and in conformation with statutory rules.
- Should be able to perform and demonstrate the practical skills in the field of ENT including the following:
 - Examination of the ear, nose and throat oral cavity examination
 - Clinico-physiological examination and evaluation of the audio-vestibulo neurological system
 - Examination of the larynx and the throat including flexible endoscopy, stroboscopy, voice analysis and the clinico-physiological examination of the speech
 - Examination of the otological and audiological system including Tuning fork testing, audiological evaluation, micro and otoendoscopy
 - Clinical and physiological evaluation of the nose and paranasal sinuses including nasal endoscopy and olfactory evaluation
 - Examination of the neck and its structures
- Should demonstrate and perform various therapeutic skills related to the speciality such as :
 - Tracheostomy
 - Anterior/ posterior nasal packing
 - Ear Packing and Syringing
 - Foreign body removal from air nose and throat

- Airway management including basic life support skills, Cardiopulmonary resuscitation, intubation, homeostasis maintenance, IV alimentation and fluid, electrolyte maintenance and principles of blood transfusion alimentation including Nasogastric feeding, gastrostomy
- Wound suturing, dressings and care of the wounds
- Basic principles of rehabilitation
- common procedures like FNAC, biopsy, aspiration from serous cavities, lumbar puncture etc.
- Should understand principles of and interpret X-rays/CT/MRI, audiograms, ENG, BERA, OAE, ultrasonographic abnormalities and other diagnostic procedures in relation to the speciality
- Should have observed/performed under supervision the various surgical procedures in relation to the speciality

COURSES OUTCOMES

Syllabus

Course contents:

1. Anatomy and Physiology of Ear, Nose and Throat, Trachea and esophagus.
2. The generation and reception of speech
3. Radiographic anatomy of the ear, nose, throat and imaging.
4. Bacteriology in relation to Otorhinolaryngology
5. Allergy and rhinitis
6. Haematology in relation to Otolaryngology
7. Anaesthesia for Otolaryngology
8. Pharmacology of drugs used in ENT
9. Electrolyte, fluid balance/shock conditions
10. Use of teaching aids
11. Routine blood, urine testing
12. Preparation of slides
13. Facial nerve stimulation test
14. Audiometric tests like pure tone Audiometry, Impedance Audiometry, Free field Audiometry, Specialized tests of hearing including SISI, Tone decay, ABLB, Speech discrimination score etc.
15. Vestibular tests like caloric testing (Water and Air) stopping test, Fukuda's test,
16. Evoked response audiometry.

Ear:

1. The physical and functional examination of the ear
2. The functional and physical examination of the vestibular system.
3. Tinnitus
4. Affections of external ear
5. Repair of deformities of the external ear.

6. Congenital conditions of the middle ear cleft
7. Traumatic conductive deafness
8. Acute inflammation of the middle ear cleft
9. Non-suppurative otitis media
10. Chronic suppurative otitis media
11. Management of chronic suppurative otitis media
12. Complications of infections of middle ear.
13. Tumors of the middle ear cleft and temporal bone
14. Diseases of the otic capsule-otosclerosis
15. Diseases of the otic capsule-other diseases
16. The deaf child
17. Acoustic neuroma
18. Ototoxicity
19. Presbycusis
20. Diagnosis and management of sudden and fluctuant sensorineural hearing loss
21. Meniere's disease
22. Neurologic aspects of vertigo
23. Facial paralysis
24. Rehabilitation of adults with acquired Hearing loss-Hearing aids
25. The cochlear Implants
26. Nystagmus
27. Otoacoustic emissions

Nose:

1. Examination of the nose
2. Conditions of the external nose
3. Injuries of the facial skeleton
4. Congenital diseases of the nose
5. The nasal septum
6. Foreign bodies in the nose, rhinolith
7. Epistaxis
8. Acute chronic inflammations of the nasal cavities
9. Vasomotor rhinitis-allergic and non-allergic
10. Nasal polyposis
11. Abnormalities of smell
12. Acute sinusitis
13. Chronic sinusitis
14. Nasal Allergy/Fungal allergic sinusitis
15. Complications of acute and chronic sinusitis
16. Tumors of nose and sinuses
17. Facial pains
18. Trans-ethmoidal hypophysectomy

19. Functional endoscopic sinus surgery (FESS)

Throat:

1. Methods of examination of the mouth and pharynx
2. Diseases of the mouth
3. Diseases of the salivary glands
4. Pharyngeal lesions associated with general diseases
5. Diseases of the tonsils and adenoids (excluding neoplasms)
6. Tumors of the pharynx
7. Hypopharyngeal diverticulum (Pharyngeal Pouch)
8. Methods of examining and larynx and tracheobronchial tree
9. Congenital diseases of the larynx
10. Laryngeal disorders in singers and other voice users
11. Neurological affections of larynx and pharynx
12. Intubation of the larynx, laryngotomy and tracheostomy
13. Cervical node dissection
14. Skin grafts in Otolaryngology and reconstructive methods including regional and distant flaps for repair of defects after excision of tumors or trauma.
15. Micro laryngeal surgery/thyroplasty

Miscellaneous and head and neck:

1. Cranial nerves
2. Raised intracranial tension-causes, diagnosis, management with particular reference to otitis hydrocephalus
3. Head injuries and I.C. Haemorrhage
4. Pituitary gland, anatomy, physiology hypo - and hyper - pituitarism, new growths.
5. Intracranial venous sinuses and their affections
5. Osteology: skull, mandible cervical and thoracic vertebral sternum
6. Cervical fascia, facial spaces in neck, retro-pharyngeal and parapharyngeal Abscesses
7. Anatomy and physiology of thyroid gland, goitre, diseases of the thyroid and carcinoma of thyroid
8. Large blood vessels in neck, thoracic duct development of major cervical and thoracic blood vessels.
9. Head and neck reconstructive surgery

Drugs used in ENT:

1. Antibiotics Antihistaminic
2. Nasal vasoconstrictors
3. Local anaesthetics
4. Corticosteroids

5. Cyto-toxic agents
6. Antibiotics
7. Radioactive isotopes
8. Antifungal agents
9. Vasopressive and other agents used in shock like states.

General:

1. Physiology of circulation, regulation of blood pressure, reactions of body to haemorrhage, patho-physiology of shock, fluid balance, blood transfusion and its hazards, fluid replacement therapy, burns
2. Agents used in shock like states

Desirable

1. The ears and nasal sinuses in the aerospace environment
2. Physiological consideration of pressure effects on the ear and sinuses in deep water diving
3. The principles of cancer immunology with particular reference to head and neck cancer
4. Principles of chemotherapy in head and neck cancer
5. Recording of nystagmus by ENG and its interpretation

Ear:

1. Traumatic lesions of the inner ear
2. Inflammatory lesions of the vestibular and auditory nerve
3. Vascular lesions of the inner ear
4. Electronystagmography
5. Skull base/Neurologic surgery

Nose:

1. Cosmetic surgery of the nose
2. Non-healing granuloma of the nose
3. Surgery of the pterygopalatine fossa
4. LASER Surgery

Throat:

1. Oesophageal conditions in the practice of ear, nose and throat surgery
2. Disorders of speech
3. Lower respiratory conditions in Otolaryngology

Miscellaneous and head and neck

1. Functional Anatomy of cerebellum and brainstem

2. Anatomy of mediastinum
3. Pleura, plural cavity, broncho-pulmonary segments and their clinical importance
4. Facial plastic surgery

MS-OPHTHALMOLOGY

Program Outcomes

The clinical post graduate training programmes are intended at developing in a student a blend of qualities that of a clinical specialist, a teacher and a researcher. These programmes are organized such that a post graduate student should possess the following qualities, knowledge and skills:

PO1. The student should possess basic knowledge of the structure, function and development of the human body as related to ophthalmology, of the factors which may disturb these mechanisms and the disorders of structure and function which may result thereafter.

PO2. The student should be able to practice and handle most day-to-day problems independently in ophthalmology. The student should recognize the limitations of his/her own clinical knowledge and know when to seek further help.

PO3. The student should understand the effects of environment on health and be familiar with the epidemiology of at least the more common diseases in the field of ophthalmology.

PO4. The student should be able to integrate the preventive methods with the curative and rehabilitative measures in the comprehensive management of the disease.

PO5. The student should be familiar with common eye problems occurring in rural areas and be able to deal with them effectively.

PO6. The student should also be made aware of Mobile Ophthalmic Unit and its working and components.

PO7. The student should be familiar with the current developments in Ophthalmic Sciences.

PO8. The student should be able to plan educational programmes in Ophthalmology in association with senior colleagues and be familiar with the modern methods of teaching and evaluation.

PO9. The student should be able to identify a problem for research, plan a rational approach to its solution, execute it and critically evaluate his/her data in the light of existing knowledge.

PO10. The student should reach the conclusions by logical deduction and should be able to assess evidence both as to its reliability and its relevance.

PO11. The student should have basic knowledge of medico-legal aspects of medicine.

PO12. The student should be familiar with patient counselling and proper consent taking.

PO13. Complete knowledge of recent advances in all topics of ophthalmology like laser, LASIK OCT, Phacoemulsification work.

PO14. Coordinate interdisciplinary team like medicine, surgery, neurosurgery, OMFS

PO15. Detailed knowledge of procedure of eye donation and corneal transplant

SUBJECT SPECIFIC COMPETENCIES

A post graduate student upon successfully qualifying in the M.S. (Ophthalmology) examination should be able to:

- a) Offer to the community, the current quality of 'standard of care' in ophthalmic diagnosis as well as therapeutics, medical or surgical, in most of the common situations encountered at the level of health services.
- b) Periodically self assess his or her performance and keep abreast with ongoing advances in the field and apply the same in his/her practice.
- c) Be aware of her/his own limitations to the application of the specialty in situations, which warrant referral to more qualified centers or individuals.
- d) Apply research and epidemiological methods during his/her practice. The post graduate student should be able to present or publish work done by him/her.
- e) Contribute as an individual/group towards the fulfillment of national objectives with regard to prevention of blindness.
- f) Effectively communicate with patients or relatives so as to educate them sufficiently and give them the full benefit of informed consent to treatment and ensure compliance.

At the end of the course, the student should have acquired knowledge in the following:

A. Cognitive domain

Basic Medical Sciences:

- Attain understanding of the structure and function of the eye and its parts in health and disease.
- Attain understanding and application of knowledge of the structure and function of the parts of Central Nervous System and other parts of the body with influence or control on the structure and function of the eye.
- Attain understanding of and develop competence in executing common general laboratory procedures employed in diagnosis and research in Ophthalmology.

1. Clinical Ophthalmology:

Given adequate opportunity to work on the basis of graded responsibilities in outpatients, inpatient and operation theatres on a rational basis in the clinical sections from the day of entry to the completion of the training programme, the students should be able to:

- Acquire scientific and rational approach to the diagnosis of ophthalmic cases presented.
- Acquire understanding of and develop inquisitiveness to investigate to establish cause and effect of the disease.
- To manage and treat all types of ophthalmic cases.
- To competently handle and execute safely all routine surgical procedures on lens, glaucoma, lid, sac, adnexa, retina and muscle anomalies.
- To competently handle all ophthalmic medical and surgical emergencies.
- To be familiar with micro-surgery and special surgical techniques.
- To demonstrate the knowledge of the pharmacological (including toxic) aspects of drugs used in ophthalmic practice and drugs commonly used in general diseases affecting the eyes.

2. Refraction:

- Acquire competence in assessment of refractive errors and prescription of glasses for all types of refraction problems.
- Acquire basic knowledge of manufacture and fitting of glasses and competence of judging the accuracy and defects of the dispensed glasses.

3. Ophthalmic super-specialties:

Given an opportunity to work on a rotational basis in various special clinics of sub-specialties of ophthalmology, if possible, the student should be able to:

- Examine, diagnose and demonstrate understanding of management of the problems of neuro-ophthalmology and refer appropriate cases to neurology and neuro-surgery.
- Examine, diagnose and demonstrate understanding of management of (medical and surgical) complicated problems in the field of (a) lens, (b) glaucoma, c) cornea, (d) retina, (e) pediatric ophthalmology, (f) oculoplasty, (g) uvea, and (I) genetic problems in ophthalmology.
- To demonstrate understanding of the manufacture, and competence in prescription and dispensing of contact lenses and ocular prosthesis.

5. Ophthalmic pathological/microbiological/biochemical sciences

- Be able to interpret the diagnosis in correlation with the clinical data and routine materials received in such cases.

6. Community Ophthalmology

Eye camps may be conducted where the PG students are posted for imparting training to according to a set methodology. The community and school surveys may also be conducted by the post graduate students.

The post graduate students are given an opportunity to participate in surveys, eye camps. They should be able to guide rehabilitation workers in the organisation and training of the blinds in art of daily living and in the vocational training of the blind leading to gainful employment.

7. Research :

- Recognise a research problem.
- State the objectives in terms of what is expected to be achieved in the end.
- Plan a rational approach with appropriate controls with full awareness of the statistical validity of the size of the material.
- Spell out the methodology and carry out most of the technical procedures required for the study.
- Accurately and objectively record on systematic lines results and observation made.
- Analyze the data with the aid of an appropriate statistical analysis.

- Interpret the observations in the light of existing knowledge and highlight in what ways the study has advanced existing knowledge on the subject and what further remains to be done.
- Write a thesis in accordance with the prescribed instructions.
- Write at least one scientific paper as expected of International Standards from the material of this thesis.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should acquire following clinical skills:

Essential diagnostic skills:

I. Examination techniques along with interpretation

1. Slit lamp Examination

- i. Diffuse examination
- ii. Focal examination
- iii. Retroillumination – direct and indirect
- iv. Sclerotic scatter
- v. Specular reflection
- vi. Staining modalities and interpretation

2. Fundus evaluation

- Direct/Indirect ophthalmoscopy
- Fundus drawing
- 3-mirror examination of the fundus
- 78-D/90-D/60-D examination
- Amsler's charting

II. Basic investigations along with their interpretation

1. Tonometry

Tonometry - Applanation/Indentation/Non-contact

2. Gonioscopy

Gonioscopy grading of the anterior chamber angle

3. Tear/ Lacrimal function tests

- i. Staining- fluorescein and Rose Bengal
- ii. Schirmer test/tear film break up time
- iii. Syringing
- iv. Dacrocystography

4. Corneal

- Corneal scraping and cauterization
- Smear preparation and interpretation (Gram's stain /KOH)
- Media inoculation
- Keratometry - performance and interpretation
- Pachymetry
- Corneal topography - if available

5. Colour Vision evaluation

- Ishihara pseudoisochromatic plates
- Farnsworth Munsell, if available

6. Refraction

- i. Retinoscopy- Streak/ Priestley Smith
- ii. Use of Jackson's cross-cylinder
- iii. Subjective and objective refraction
- iv. Prescription of glasses

7. Diagnosis and assessment of Squint

- i. Ocular position and motility examination
- ii. Synoptophore usage
- iii. Lees screen usage
- iv. Diplopia charting
- v. Assessment of strabismus - cover tests/prisms bars
- vi. Amblyopia diagnosis and treatment
- vii. Assessment of convergence, accommodation, stereopsis, suppression

8. Exophthalmometry

Usage of Hertel's exophthalmometer - proptosis measurement

9. Contact lenses

- Fitting and assessment of RGP and soft lenses
- Subjective verification of over refraction
- Complications arising of contact lens use
- Educating the patient regarding CL usage and imparting relevant knowledge of the complications arising thereon

10. Low Vision Aids

- Knowledge of basic optical devices available and relative advantages and disadvantages of each.
- The basics of fitting with knowledge of availability & cost

III. The post graduate must be well versed with the following investigative modalities although the student may or may not perform it individually. But, she/he should be able to interpret results of the following tests:

1. Fundus photography
2. Fluorescein angiography
3. Ophthalmic ultrasound A-scan/B scan
4. Automated perimetry for glaucoma and neurological lesions
5. Radiological tests - X rays - Antero posterior/ Lateral view
PNS (Water's view) / Optic canal views

Localisation of intra-ocular and intra-orbital FBs

Interpretations of -USG/ CT/ MRI Scans
6. OCT and UBM
7. ERG, EOG, and VEP

IV. Minor surgical procedures – Must know and perform independently

- Conjunctival and corneal foreign body removal on the slit lamp
- Chalazion incision and curettage
- Pterygium excision
- Biopsy of small lid tumours
- Suture removal- skin/conjunctival/corneal/ corneoscleral
- Tarsorrhaphy
- Subconjunctival injection
- Retrobulbar, parabulbar anaesthesia
- Posterior Sub-Tenon's injections

- Artificial eye fitting

V. Surgical procedures

1. Must know and can perform independently

a. Ocular anaesthesia:

- Retrobulbar anaesthesia
- Peribulbar anaesthesia
- Facial blocks- O'Brein / Atkinson/Van lint and modifications
- Frontal blocks
- Infra orbital blocks
- Blocks for sac surgery

2. Must be able to independently perform and deal with complications arising from the following surgeries :

- Lid Surgery - Tarsorrhaphy
 Ectropion and entropion
 Lid repair following trauma
 Epilation
- Destructive procedures
 Evisceration with or without implant
 Enucleation with or without implant
- Sac surgery
 - i. Dacryocystectomy
 - ii. Dacryocystorhinostomy
 - iii. Probing for congenital obstruction of nasolacrimal duct
- Strabismus surgery
 Recession and resection procedures on the horizontal recti.
- Orbit surgery
 Incision and drainage via anterior orbitotomy for abscess
- Cyclocryotherapy/Cyclophotocoagulation

3. PG Students should be well conversant with use of operating microscope and must be able to perform the surgeries listed below competently under the same:

- Cataract surgery
 - i. Standard ECCE (extracapsular cataract extraction; first year) with or without IOL implantation

- ii. Small incision ECCE with or without IOL implantation and/or Phacoemulsification with PC IOL implantation
 - iii. Intracapsular cataract extraction (second year)
 - iv. Cataract with Phacoemulsification (third year)
 - v. Secondary AC or PC IOL implantation
 - Vitrectomy/Scleral buckling
 - Intra-vitreous and intra-cameral (anterior chamber) injection techniques and doses of drugs for the same
 - Needs to know the basis of open sky vitrectomy (anterior segment) as well as management of cataract surgery complications.
 - Assisting vitrectomy and scleral buckling procedures
 - Ocular surface procedures
 - Pterygium excision with modifications
 - Conjunctival cyst excision/foreign body removal
 - Corneal foreign body removal
 - Conjunctival flap/ peritomy
 - Glaucoma
 - Trabeculectomy
 - Corneal
 - Repair of corneo - scleral perforations
 - Corneal suture removal
 - Application of glue and bandage contact lens
4. Should have performed/assisted the following microscopic surgeries
- i. Keratoplasty
 - Therapeutic and optical
 - ii Glaucoma surgery
 - Pharmacological modulation of trabeculectomy
 - Trabeculectomy
 - Goniotomy
 - Glaucoma valve implant surgery
5. Desirable to be able to perform following laser procedures
- Yag Capsulotomy
 - Laser iridotomy
 - Focal and panretinal photocoagulation
6. Should have assisted/knowledge of Keratorefractive procedures

Operations:

The PG is provided with an opportunity to perform operations both extra-ocular and intra-ocular with the assistance of the senior post graduate students and/or under the direct supervision of a faculty member. The student is provided with an opportunity

to learn special and complex operations by assisting the senior post graduate student or the faculty in operations of cases of the specialty and be responsible for the post-operative care of these cases.

In **first phase**, the post graduate student is given training in preparations of cases for operation, pre-medication and regional anaesthetic blocks. In the **next phase**, the post graduate student assists the operating surgeon during the operations. In the **third phase**, the post graduate student operates independently assisted by senior post graduate student or a faculty member. She/he is required to be proficient in some operations and show familiarity with others.

COURSE OUTCOME

Syllabus

Course contents:

These are only broad guidelines and are illustrative, there may be overlap between sections.

I. Basic Sciences:

1. Orbital and ocular anatomy
 - i. Gross anatomy
 - ii. Histology
 - iii. Embryology
2. Ocular Physiology
3. Ocular Pathology
4. Ocular Biochemistry
 - General biochemistry, biochemistry applicable to ocular function
5. Ocular Microbiology
 - General Microbiology, specific microbiology applicable to the eye
6. Immunology with particular reference to ocular immunology
7. Genetics in ophthalmology
8. Community Eye Health

II. Optics

- a. Basic physics of optics
- b. Applied ophthalmic optics
- c. Applied optics including optical devices
- d. Disorders of Refraction

III. Clinical Ophthalmology

- i. Disorders of the lids
- ii. Disorders of the lacrimal system
- iii. Disorders of the Conjunctiva
- iv. Disorders of the Sclera

- v. Disorders of the Cornea
- vi. Disorders of the Uveal Tract
- vii. Disorders of the Lens
- viii. Disorders of the Retina
- ix. Disorders of the Optic Nerve and Visual Pathway
- x. Disorders of the Orbit
- xi. Glaucoma
- xii. Neuro-ophthalmology
- xiii. Paediatric ophthalmology
- xiv. Ocular involvement in systemic disease
- xv. Immune ocular disorders
- xvi. Strabismus and Amblyopia
- xvii. Ocular oncology

MS-OBSTETRICS AND GYNAECOLOGY

Program Outcomes

Obstetrician and Gynaecologist who can:

PO1. Provide quality care to the community in the diagnosis and management of Antenatal, Intra-natal and Post-natal period of normal and abnormal pregnancy and labour.

PO2. Provide effective and adequate care to a pregnant woman with complicated pregnancy.

PO3. Provide effective and adequate care to a normal and high risk neonate.

PO4. Perform obstetrical ultrasound in normal and abnormal pregnancy including Doppler.

PO5. Manage effectively all obstetrical and gynaecological emergencies and if necessary, make appropriate referrals.

PO6. Provide quality care to the community in the diagnosis and management of gynaecological problems including screening, and management of all gynaecological cancers including during pregnancy. g. conducts a comprehensive evaluation of infertile couple and have a broad based knowledge of assisted reproductive techniques including – ovulation induction, in vitro fertilization and intra-cytoplasmic sperm injection, gamete donation, surrogacy and the legal and ethical implications of these procedures.

PO7. Provide counseling and delivery of fertility regulation methods including reversible and irreversible contraception, emergency contraception etc.

PO8. Provide quality care to women having spontaneous abortion or requesting Medical Termination of Pregnancy (MTP) and manage their related complications.

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive Domain

At the end of the MS Course in Obstetrics and Gynaecology, the student should have acquired knowledge in the following:

- recognizes the health needs of women and adolescents and carries out professional obligations in keeping with principles of National Health Policy and professional ethics
- has acquired the competencies pertaining to Obstetrics and Gynaecology that are required to be practiced in the community and at all levels of health system
- on genetics as applicable to Obstetrics.
- on benign and malignant gynecological disorders.
- on Gynecological Endocrinology and infertility.
- on interpretation of various laboratory investigations and other diagnostic modalities in Obstetrics & Gynecology.
- on essentials of Pediatric and adolescent Gynecology.
- on care of postmenopausal women and geriatric Gynecology.
- on elementary knowledge of female breast & its diseases.
- on vital statistics in Obstetrics & Gynecology.
- Anesthesiology related to Obstetrics & Gynecology.
- Reproductive and Child Health, family welfare & reproductive tract infections.
- STD and AIDS & Government of India perspective on women's health related issues.
- Medico-legal aspects in Obstetrics & Gynecology.
- Asepsis, sterilization and disposal of medical waste.
- be able to effectively communicate with the family and the community
- is aware of the contemporary advances and developments in medical sciences as related to Obstetrics and Gynaecology.

- maintain medical records properly and know the medico-legal aspects in respect of Obstetrics & Gynecology
- Understands the difference between audit and research and how to plan a research project and demonstrate the skills to critically appraise scientific data and literature
- has acquired skills in educating medical and paramedical professionals

Ethical and Legal Issues:

The post graduate student should understand the principles and legal issues surrounding informed consent with particular awareness of the implication for the unborn child, postmortem examinations consent to surgical procedures including tubal ligation/vasectomy, parental consent and medical certification, research and teaching and properly maintain medical records.

Risk Management:

The post graduate student should demonstrate a working knowledge of the principles of risk management and their relationship to clinical governance and complaints procedures.

Confidentiality:

The post graduate student should:

- be aware of the relevant strategies to ensure confidentiality and when it might be broken.
- understand the principles of adult teaching and should be able to teach common practical procedures in Obstetrics and Gynaecology and involved in educational programme in Obstetrics and Gynaecology for medical and paramedical staff.
- be abreast with all recent advances in Obstetrics and Gynaecology and practice evidence based medicine.

Use of information technology, audits and standards:

The post graduate student should:

- acquire a full understating of all common usage of computing systems including the principles of data collection, storage, retrieval, analysis and presentation.
- understand quality improvement and management and how to perform, interpret and use of clinical audit cycles and the production and application of clinical standards, guidelines and protocols.

- understand National Health Programmes related to Obstetrics and Gynaecology and should be aware of all the Acts and Laws related to specialty.

Health of Adolescent Girls and Post-Menopausal Women

The student should:

- Recognize the importance of good health of adolescent and postmenopausal women.
- Identification and management of health problems of post-menopausal women.
- Understanding and planning and intervention program of social, educational and health needs of adolescent girls and menopausal women.
- Education regarding rights and confidentiality of women's health, specifically related to reproductive function, sexuality, contraception and safe abortion.
- Geriatric problems.

Reproductive Tract and 'HIV' Infection

- Epidemiology of RTI and HIV infection in Indian women of reproductive age group.
- Cause, effect and management of these infections.
- HIV infections in pregnancy, its effects and management.
- Relationship of RTI and HIV with gynaecological disorders.
- Planning and implementation of preventive strategies.

Medico-legal Aspects

- Knowledge and correct application of various Acts and Laws while practicing Obstetrics and Gynaecology, particularly MTP Act and sterilization, Preconception and P.N.D.T. Act.
- Knowledge of importance of proper recording of facts about history, examination findings, investigation reports and treatment administered in all patients.
- Knowledge of steps recommended for examination and management of rape cases.
- Knowledge of steps taken in the event of death of a patient.

B. Affective domain

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.

2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should acquire following clinical & operative skills and be able to:

Operative Skills in Obstetrics and Gynaecology

- Adequate proficiency in common minor and major operations, post-operative management and management of their complications.
- Operative procedures which must be done by P G students during training period: *(in graded manner - assisting, operating with senior person assisting, operating under supervision)*

(Operations MUST BE DONE/OBSERVED during PG training programme and log book maintained)

1. Obstetrics: Venesection, culdocentesis

Conduct normal deliveries

Episiotomy and its repair

- Application of forceps and ventouse (10).
- Carry out caesarian section delivery (10 must be done)
- Manual removal of placenta
- Management of genital tract obstetrical injuries.
- Post partum sterilization/Minilap tubal ligation (20 must be done)
- Medical termination of pregnancy - various methods (20 must be done)

2. Gynaecology: Endometrial / cervical biopsy.

Dilatation and curettage

Coldocentesis, Colpotomy

- Opening and closing of abdomen (10 must be done)
- Operations for pelvic organ prolapse
- Ovarian cyst operation
- Operation for ectopic pregnancy
- Vaginal and abdominal hysterectomy

Operations must be OBSERVED and/or ASSISTED when possible:

- Internal podalic version
- Caesarea Hysterectomy
- Internal iliac artery ligation
- Destructive obstetrical operations
- Tubal microsurgery
- Radical operations for gynaec malignancies
- Repair of genital fistulae
- Operations for incontinence
- Myomectomy, Laparoscopic and hysteroscopic surgery

Diagnostic Procedures

- Interpretation of x-rays - Twins, common fetal malformations / mal-presentations, abnormal pelvis (pelvimetry), Hysterosalpingography
- Sonographic pictures at various stages of pregnancy - normal and abnormal pregnancies, Fetal biophysical profile, common gynaecological pathologies.
- Amniocentesis
- Fetal surveillance methods - Electronic fetal monitoring and its interpretation
- Post-coital test
- Vaginal Pap Smear
- Colposcopy
- Endoscopy - Laparo and Hystero-scopy.

Health of Adolescent Girls and Post-Menopausal Women

- Provide advice on importance of good health of adolescent and postmenopausal women.
- Identification and management of health problems of post-menopausal women.
- Planning and intervention program of social, educational and health needs of adolescent girls and menopausal women.
- Provide education regarding rights and confidentiality of women's health, specifically related to reproductive function, sexuality, contraception and safe abortion.
- Provide advice on geriatric problems.

Reproductive Tract and 'HIV' Infection

- Provide advice on management of RTI and HIV infections in Indian women of reproductive age group.

- Provide advice on management of HIV infections in pregnancy, relationship of RTI and HIV with gynaecological disorders.
- Planning and implementation of preventive strategies.

Medico-legal Aspects

- Correct application of various Acts and Laws while practicing obstetrics and gynaecology, particularly MTP Act and sterilization, Preconception and P.N.D.T. Act.
- Implement proper recording of facts about history, examination findings, investigation reports and treatment administered in all patients.
- Implement the steps recommended for examination and management of rape cases.
- Follow proper procedures in the event of death of a patient.

Environment and Health

- Follow proper procedures in safe disposal of human body fluids and other materials.
- Follow proper procedures and universal precautions in examination and surgical procedures for the prevention of HIV and other diseases.

COURSES OUTCOME

Syllabus

Course Contents:

Paper I

1. Basic Sciences

- Normal and abnormal development, structure and function (female and male) urogenital system and female breast.
- Applied Anatomy of genito-urinary system, abdomen, pelvis, pelvic floor, anterior abdominal wall, upper thigh (inguinal ligament, inguinal canal, vulva, rectum and anal canal).
- Physiology of spermatogenesis.
- Endocrinology related to male and female reproduction (Neurotransmitters).
- Anatomy and physiology of urinary and lower GI (Rectum / anal canal) tract.
- Development, structure and function of placenta, umbilical cord and amniotic fluid.
- Anatomical and physiological changes in female genital tract during pregnancy.
- Anatomy of fetus, fetal growth and development, fetal physiology and fetal circulation.
- Physiological and neuro-endocrinal changes during puberty, adolescence, menstruation, ovulation, fertilization, climacteric and menopause.

- Biochemical and endocrine changes during pregnancy, including systemic changes in cardiovascular, hematological, renal hepatic, renal, hepatic and other systems.
- Biophysical and biochemical changes in uterus and cervix during pregnancy and labor.
- Pharmacology of identified drugs used during pregnancy, labour, post-partum period in reference to their absorption, distribution, excretion, (hepatic) metabolism, transfer of the drugs across the placenta, effect of the drugs (used) on labor, on fetus, their excretion through breast milk.
- Mechanism of action, excretion, metabolism of identified drugs used in the management of Gynaecological disorder.
- Role of hormones in Obstetrics and Gynaecology.
- *Markers in Obstetrics & Gynaecology* - Non-neoplastic and neoplastic diseases
- Pathophysiology of ovaries, fallopian tubes, uterus, cervix, vagina and external genitalia in healthy and diseased conditions.
- Normal and abnormal pathology of placenta, umbilical cord, amniotic fluid and fetus.
- Normal and abnormal microbiology of genital tract. Bacterial, viral and parasitical infections responsible for maternal, fetal and gynaecological disorders.
- Humoral and cellular immunology in Obstetrics & Gynaecology.
- Gametogenesis, fertilization, implantation and early development of embryo.
- Normal Pregnancy, physiological changes during pregnancy, labor and pauperism.
- Immunology of pregnancy.
- Lactation.

2. Medical Genetics

- Basic medical genetics including cytogenetics.
- Pattern of inheritance
- Chromosomal abnormalities - types, incidence, diagnosis, management and recurrence risk.
- General principles of Teratology.
- Screening, counseling and prevention of developmental abnormalities.
- Birth defects - genetics, teratology and counseling.

Paper II

Clinical obstetrics

1. Antenatal Care:

- Prenatal care of normal pregnancy including examination, nutrition, immunization and follow up.
- Identification and management of complications and complicated of pregnancy – abortion, ectopic pregnancy, vesicular mole, Gestational trophoblastic Diseases, hyperemesis gravidarum, multiple pregnancy, antipartum hemorrhage, pregnancy induced hypertension, preeclampsia, eclampsia, Other associated hypertensive disorders, Anemia, Rh incompatibility, diabetes, heart disease, renal and hepatic diseases, preterm - post term pregnancies, intrauterine fetal growth retardation,
- Neurological, hematological, dermatological diseases, immunological disorders and other medical and surgical disorders/problems associated with pregnancy, Multiple pregnancies, Hydramnios, Oligoamnios.
- Diagnosis of contracted pelvis (CPD) and its management.
- High-risk pregnancy
 - Pregnancy associated with complications, medical and surgical problems.
 - Prolonged gestation.
 - Preterm labor, premature rupture of membranes.
 - Blood group incompatibilities.
 - Recurrent pregnancy wastage.
- Evaluation of fetal and maternal health in complicated pregnancy by making use of diagnostic modalities including modern ones (USG, Doppler, Electronic monitors) and plan for safe delivery for mother and fetus. Identifying fetus at risk and its management. Prenatal diagnostic modalities including modern ones.
- Infections in pregnancy (bacterial, viral, fungal, protozoan)
 - Malaria, Toxoplasmosis.
 - Viral – Rubella, CMV, Herpes, HIV, Hepatic viral infections (B, C etc)
 - Sexually Transmitted Infections (STDs)
 - Mother to fetal transmission of infections.
- Identification and management of fetal malpositions and malpresentations.
- Management of pregnancies complicated by medical, surgical (with other specialties as required) and gynecological diseases.
 - Anemia, hematological disorders
 - Respiratory, Heart, Renal, Liver, skin diseases.
 - Gastrointestinal, Hypertensive, Autoimmune, Endocrine disorders.
 - Associated Surgical Problems.
 - Acute Abdomen (surgical emergencies - appendicitis and GI emergencies).
 - Other associated surgical problems.
 - Gynaecological disorders associate with pregnancy - congenital genital tract developmental anomalies, Gynaec pathologies - fibroid uterus, Ca Cx, genital prolapse etc.
 - Prenatal diagnosis (of fetal problems and abnormalities), treatment – Fetal therapy
 - M.T.P, PC & P.N.D.T Act etc

- National health MCH programs, social obstetrics and vital statistics
- Recent advances in Obstetrics.

2. Intra-partum care:

- Normal labor - mechanism and management.
- Partographic monitoring of labor progress, recognition of abnormal labor and its appropriate management.
- Identification and conduct of abnormal labor and complicated delivery - breech, forceps delivery, caesarian section, destructive operations.
- Induction and augmentation of labor.
- Management of abnormal labor - Abnormal pelvis, soft tissue abnormalities of birth canal, mal-presentation, mal-positions of fetus, abnormal uterine action, obstructed labor and other distocias.
- Analgesia and anaesthesia in labor.
- Maternal and fetal monitoring in normal and abnormal labor (including electronic fetal monitoring).
- Identification and management of intrapartum complications, Cord presentation, complication of 3rd stage of labor - retained placenta, inversion of uterus, rupture of uterus, post partum hemorrhage.

3. Post Partum

- Complication of 3rd stage of labor retained placenta, inversion of uterus, post partum hemorrhage, rupture of uterus, Management of primary and secondary post-partum hemorrhage, retained placenta, uterine inversion. Post-partum collapse, amniotic fluid embolism
- Identification and management of genital tract trauma - perineal tear, cervical/vaginal tear, episiotomy complications, rupture uterus.
- Management of critically ill woman.
- Post partum shock, sepsis and psychosis.
- Postpartum contraception.
Breast feeding practice; counseling and importance of breast-feeding. Problems in breast-feeding and their management, Baby friendly practices.
- Problems of newborn - at birth (resuscitation), management of early neonatal problems.
- Normal and abnormal purpura - sepsis, thrombophlebitis, mastitis, psychosis.
Hematological problems in Obstetrics including coagulation disorders. Use of blood and blood components/products.

4. Operative Obstetrics:

- Decision-making, technique and management of complications.
- Vaginal instrumental delivery, Caesarian section, Obst. Hysterectomy, destructive operations, manipulations (External/internal podalic version, manual removal of placenta etc)
- Medical Termination of Pregnancy - safe abortion - selection of cases, technique and management of complication. MTP law.

5. New Born

1. Care of new born: Normal and high risk new born (including NICU care).
2. Asphyxia and neonatal resuscitation.
3. Neonatal sepsis - prevention, detection and management.
4. Neonatal hyper - bilirubinemia - investigation and management.
5. Birth trauma - Detection and management.
6. Detection and management of fetal/neonatal malformation.
7. Management of common neonatal problems.

Paper III

Clinical Gynaecology and Fertility Regulation

- Epidemiology and etiopathogenesis of gynaecological disorders.
- Diagnostic modalities and management of common benign and malignant gynaecological diseases (diseases of genital tract):
 - Fibroid uterus
 - Endometriosis and adenomyosis
 - Endometrial hyperplasia
 - Genital prolapse (uterine and vaginal)
 - Cervical erosion, cervicitis, cervical polyps, cervical neoplasia.
 - Vaginal cysts, vaginal infections, vaginal neoplasia (VIN)
 - Benign Ovarian pathologies
 - Malignant genital neoplasia - of ovary, Fallopian tubes, uterus, cervix, vagina, vulva and Gestational Trophoblastic diseases, Cancer Breast.
- Diagnosis and surgical management of clinical conditions related to congenital malformations of genital tract. Reconstructive surgery in gynaecology.
- Intersex, ambiguous sex and chromosomal abnormalities.
- Reproductive endocrinology: Evaluation of Primary/secondary Amenorrhea, management of Hyperprolactinemia, Hirsutism, Chronic an-ovulation, PCOD, thyroid and other endocrine dysfunctions.
- Infertility - Evaluation and management
 - Methods of Ovulation Induction

- Tubal (Micro) surgery
- Management of immunological factors of Infertility
- Male infertility
- Obesity and other Infertility problems.
- **(Introductory knowledge of)** Advanced Assisted Reproductive Techniques (ART)
- Reproductive tract Infections: prevention, diagnosis and treatment.
 - STD
 - HIV
 - Other Infections
 - Genital Tuberculosis.
- Principles of radiotherapy and chemotherapy in gynaecological malignancies. Choice, schedule of administration and complications of such therapies.
- Rational approach in diagnosis and management of endocrinal abnormalities such as: menstrual abnormalities, amenorrhea (primary/secondary), dysfunctional uterine bleeding, polycystic ovarian disease, hyperprolactinemia (galactorrhea), hyperandrogenism, thyroid - pituitary - adrenal disorders, menopause and its treatment (HRT).
- Urological problems in Gynaecology - Diagnosis and management.
 - Urinary tract infection
 - Urogenital Fistulae
 - Incontinence
 - Other urological problems
- Orthopedic problems in Gynaecology.
- Menopause: management (HRT) and prevention of its complications.
- Endoscopy (Laparoscopy - Hysteroscopy)
 - Diagnostic and simple therapeutic procedures (PG students must be trained to do these procedures)
 - Recent advances in gynaecology - Diagnostic and therapeutic
 - Pediatric, Adolescent and Geriatric Gynaecology
 - **Introduction to Advance Operative procedures.**

Operative Gynaecology

- Abdominal and Vaginal Hysterectomy
- Surgical Procedures for genital prolapse, fibromyoma, endometriosis, ovarian, adenexal, uterine, cervical, vaginal and vulval pathologies.
- Surgical treatment for urinary and other fistulae, Urinary incontinence
- Operative Endoscopy

Family Welfare and Demography

- Definition of demography and its importance in Obstetrics and Gynaecology.

- Statistics regarding maternal mortality, perinatal mortality/morbidity, birth rate, fertility rate.
- Organizational and operational aspects of National health policies and programs, in relation to population and family welfare including RCH.
- Various temporary and permanent methods of male and female contraceptive methods.
- Knowledge of in contraceptive techniques (including recent developments).
 1. Temporary methods
 2. Permanent Methods.
 3. Recent advances in contraceptive technology
- Provide adequate services to service seekers of contraception including follow up.
- Medical Termination of Pregnancy: Act, its implementation, providing safe and adequate services.
- Demography and population dynamics.
- Contraception (fertility control)

Male and Female Infertility

- History taking, examination and investigation.
- Causes and management of male infertility.
- Indications, procedures of Assisted Reproductive Techniques in relation to male infertility problems.

MD-ANAESTHESIA

Program Outcomes:

PO1. Describe the development and history of anaesthesia as a specialty with knowledge of important personalities who have contributed towards it.

PO2. Demonstrate knowledge of Anatomy related to:

- Diaphragm, upper and lower airway lung, heart and coronary circulation, liver and kidney.
- Regional anaesthesia - field block, central neuraxial, blockade, block for acute pain states.
- Procedures like -Intramuscular injections, arterial and venous cannulations.
- Patient Positioning under anaesthesia.

PO3. Demonstrate knowledge of Physiology of various systems (respiratory, cardiovascular, hepatobiliary, renal, endocrine, during pregnancy, haematological, neuromuscular, regulation of temperature and metabolism, stress response, cerebral blood flow and ICP, central, autonomic and peripheral nervous systems, metabolic response to stress and trauma) in detail and translate its application in a problem solving manner.

PO4. Demonstrate knowledge of Biochemistry relevant to fluid balance and blood transfusion, preoperative fluid therapy, acid base homeostasis in health and diseases.

PO5. Demonstrate knowledge of commonly used drugs in anaesthesia practice (premedication, induction agents - intra-venous and inhalational, neuromuscular blocking agents and reversal of muscle relaxants) - general principles, concepts of 3 pharmacokinetics and pharmacodynamics, drug interactions with the other drugs taken concomitantly by the patient and anaphylactoid reactions.

PO6. Demonstrate knowledge of gas laws, medical gas supply system, fluidics, electricity, diathermy and oxygen therapy.

PO7. Demonstrate knowledge of 'principles of physics' that govern functions of basic anaesthesia delivery equipment, airway devices – (laryngoscopes, airways etc), breathing systems and monitors, fibre optics, Lasers, Pacemakers and defibrillators, monitoring equipment's (used for assessment of cardiac functions, temperature, respiratory functions, blood gases, intracranial pressure, depth of anaesthesia and neuromuscular block),

Sterilization of equipment's, manufacture, filling and transport of gases and liquid oxygen. etc.

PO8. Demonstrate knowledge of importance of pre-anaesthetic assessment and optimization of a patient; consisting of evaluation, interpretation of laboratory investigation as applied to the care of the patients in planning and conduct of general anaesthesia.

PO9. Demonstrate knowledge of basic life support, advanced cardiac, trauma life support, and neonatal resuscitation according to latest guidelines.

PO10. Demonstrate knowledge of principles of sterilization and universal precautions, selection, maintenance and sterilization of anaesthesia and related equipment, Infection control, cross contamination in OT and ICU. Immune response and anaesthesia.

PO11. Demonstrate knowledge of principles of artificial ventilation, management of unconscious patients, oxygen therapy, shock- (pathophysiology and management) and various protocols related to Intensive Care Unit.

PO12. Demonstrate knowledge pertaining to special anaesthetic techniques as relevant to:

- Outpatient anaesthesia, hypotensive anaesthesia, anaesthesia in abnormal environments including rural area and calamitous situations
- Associated medical disorders in surgical patients,
- Geriatric and paediatric anaesthesia, Emergency, ENT, orthopaedic, ophthalmology, obstetrics, dental, radio-diagnosis and radiotherapy.
- Induced hypothermia, incidental, environmental safety of patient.
- Malignant hyperthermia myasthenia gravis, GB syndrome and other neuromuscular diseases, obesity, COPD, Diabetes mellitus, bronchial asthma and hypertensive crises.
- Principles of anaesthetic management of neuro/cardiac/thoracic/vascular/Renal / Liver and Heart transplantation/burns and plastic surgery.
- Anaesthesia for patients with severe cardiac, respiratory, renal and hepatobiliary disorder posted for unrelated surgery.
- Demonstrate knowledge of post-operative care in the post-anaesthesia recovery room, in terms of management of Post-operative pain: various modalities nausea and vomiting.

PO13. Identified emergencies and postoperative complications. Special precautions to be taken in specific surgical patients.

PO14. Demonstrate knowledge of acute pain management, chronic pain therapy & therapeutic nerve blocks, acupuncture, acupressure and other non-conventional methods of treatment.

PO15. Describe documentation, medico-legal aspects of anaesthesia and concept of informed consent.

PO16. Demonstrate knowledge of research methodology and basics of biostatistics relevant to data collection, analysis, record keeping in anaesthesia, comparison and estimation of significance.

PO17. Demonstrate ability to interpret blood gas analysis and other relevant biochemical values, various function tests and basics of measurement techniques, ECG.

PO18. Explain blood coagulation mechanism, and their disturbances, rational use of blood and blood components.

PO19. Shock, types, pathogenesis and management of patients in shock, renal failure, critically ill and/or on ventilator, Multiple organ failure.

PO20. Demonstrate knowledge pertaining to care of terminally ill, Hospices management, Do not resuscitate orders.

PO21. Demonstrate knowledge of general principles of medical audit and Critical incident reporting.

PO22. Demonstrate knowledge of Ethics and clinical trial.

PO23. Demonstrate knowledge of Hospital, ICU and OT design and planning.

PO24. Demonstrate knowledge of Medical education including evidence based medical education.

PO25. Demonstrate knowledge of principles of human resources and material management.

PO26. Skill Development

- Spinal Anaesthesia
- Epidural
- Combined Spinal and Epidural
- Venous / Arterial Cannulation
- General Anaesthesia:
 - Use of mask, intubation with normal and with different types of tubes
 - Supraglottic devices
 - Use of Ambu bag.
- Different type of nerve blocks
 - PNS (Peripheral nerve stimulator)
- US Guided blocks.

SUBJECT SPECIFIC COMPETENCIES

The student during the training programme, should acquire the following competencies:

A. Cognitive domain

- Demonstrate knowledge of Anatomy related to;
 - ❖ Diaphragm, upper and lower airway, heart and coronary circulation ,
 - ❖ Regional anaesthesia -
field block, central neuraxial, blockade, block for acute
pain states
 - ❖ Procedures like -
Intramuscular injections, arterial and venous cannulations
and
 - ❖ Patient Positioning under anaesthesia

- Demonstrate knowledge of Physiology of various systems (respiratory, cardiovascular, hepatobiliary, renal, endocrine, pregnancy, haematologica
l, neuromuscular, regulation of temperature and metabolism, stress response, cerebral blood flow and ICP, central, autonomic and peripheral nervous systems, metabolic response to stress and trauma) in detail and translate its application in a problem solving manner.
- Demonstrate knowledge of Biochemistry relevant to fluid balance and blood transfusion, perioperative fluid therapy, acid base homeostasis in health and diseases.
- Demonstrate knowledge of commonly used drugs in anaesthesia practice (premedication, induction agents - intra-venous and inhalational, neuromuscular blocking agents and reversal of muscle relaxants) - general principles, concepts of

pharmacokinetics and pharmacodynamics, drug interactions with the other drugs taken concomitantly by the patient and anaphylactoid reactions.

- Demonstrate knowledge of gas laws, medical gas supply system, fluidics, electricity, diathermy and oxygen therapy.
- Demonstrate knowledge of ‘principles of physics’ that govern functions of basic anaesthesia delivery equipment, airway devices – (laryngoscopes, airways etc), breathing systems and monitors, fiber optics, Lasers, Pacemakers and defibrillators, monitoring equipments (used for assessment of cardiac functions, temperature, respiratory functions, blood gases, intracranial pressure, depth of anaesthesia and neuromuscular block), Sterilization of equipments, manufacture, filling and transport of gases and liquid oxygen. etc.
- Demonstrate knowledge of importance of pre-anaesthetic assessment and optimization of a patient; consisting of evaluation, interpretation of laboratory investigation as applied to the care of the patients in planning and conduct of general anaesthesia.
- Demonstrate knowledge of basic life support, advanced cardiac, trauma life support, and neonatal resuscitation according to latest guidelines.
- Demonstrate knowledge of principles of sterilization and universal precautions, selection, maintenance and sterilization of anaesthesia and related equipment, Infection control, cross contamination in OT and ICU. Immune response and anaesthesia.
- Describe the development and history of anaesthesia as a specialty with knowledge of important personalities who have contributed towards it.
- Demonstrate knowledge of principles of artificial ventilation, management of unconscious patients, oxygen therapy, shock- (pathophysiology and management) and various protocols related to Intensive Care Unit.
- Demonstrate knowledge of post-operative care in the post-anaesthesia recovery room, in terms of management of
 - ❖ Post-operative pain: various modalities
 - ❖ Nausea and vomiting
 - ❖ Identified emergencies and postoperative complications.
 - ❖ Special precautions to be taken in specific surgical patients.
- Demonstrate knowledge of acute pain management, chronic pain therapy & therapeutic nerve blocks, acupuncture, acupressure and other non-conventional methods of treatment.
- Describe documentation, medico-legal aspects of anaesthesia and concept of informed consent.
- Demonstrate knowledge of research methodology and basics of biostatistics relevant to data collection, analysis, record keeping in anaesthesia, comparison and estimation of significance.

- Demonstrate ability to interpret blood gas analysis and other relevant biochemical values, various function tests and basics of measurement techniques, ECG.
- Explain blood coagulation mechanism, and their disturbances, rational use of blood and blood components.
- Demonstrate knowledge pertaining to special anaesthetic techniques as relevant to:
 - ❖ Outpatient anaesthesia, hypotensive anaesthesia, anaesthesia in abnormal environments including rural area and calamitous situations
 - ❖ Associated medical disorders in surgical patients
 - ❖ Geriatric and pediatric anaesthesia, Emergency, ENT, orthopedic, ophthalmology, obstetrics, dental, radio-diagnosis and radiotherapy.
 - ❖ Induced hypothermia, incidental, environmental safety of patient.
 - ❖ Malignant hyperthermia, myasthenia gravis, GB syndrome and other neuromuscular diseases, obesity, COPD, Diabetes mellitus, bronchial asthma and hypertensive crises..
 - ❖ Principles of anaesthetic management of neuro/cardiac/thoracic/vascular/transplantation/burns and plastic surgery.
 - ❖ Anaesthesia for patients with severe cardiac, respiratory, renal and hepatobiliary disorder posted for unrelated surgery
 - ❖ Shock, types, pathogenesis and management of patients in shock, renal failure, critically ill and/or on ventilator, Multiple organ failure
- Demonstrate knowledge pertaining to care of terminally ill, Hospices management, Do not resuscitate orders.
- Demonstrate knowledge of general principles of medical audit and Critical incident reporting.
- Demonstrate knowledge of Ethics and clinical trial.
- Demonstrate knowledge of Hospital, ICU and OT design and planning.
- Demonstrate knowledge of Medical education including evidence based medical education.
- Demonstrate knowledge of principles of human resources and material management.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.

3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should acquire skills in the following broad areas and be able to:

- Demonstrate ability as a **perioperative physician**, in terms of
 - ❖ Acquiring mastery in careful and relevant history taking, physical examination in clinical evaluation of the patient preoperatively.
 - ❖ Collecting and synthesizing preoperative data from parent hospital and other sources and to develop a rational strategy for the peri-operative care of the patient.
 - ❖ Thorough and systematic approach to preoperative evaluation of patients with and without systemic diseases, undergoing different types of operations.
 - ❖ Prioritizing problems, present cases clearly and systematically to attending consultants.
 - ❖ Developing working relationships with consultants in other specialties to assist in preoperative evaluation and get a good consultation.
 - ❖ Interacting with preoperative patients and developing effective counseling techniques for different anaesthetic techniques and peri-operative procedures.
 - ❖ Assessing and explaining risk of procedure and taking informed consent.
 - ❖ Managing information in preoperative evaluation and outcome enhancement and communication skill to patients and relatives.
 - ❖ Ability to choose and order the required investigations to be done in a particular patient peri operatively
- Demonstrate ability in performing
 - ❖ Pre-operative equipment check
 - ❖ selection of drugs
 - ❖ Preparation of work table etc.
- Identify conditions like difficult airway by following difficult airway algorithms.
- Demonstrate ability to establish topical airway anaesthesia for awake intubation
- Demonstrate management of a Failed intubation drill on a Mannequin according to latest guidelines
- Demonstrate ability to monitor and assess depth of anaesthesia
- Demonstrate abilities to manage body fluid composition; volume status; replacement of fluid and blood loss; use of whole blood and blood components.

- Demonstrate abilities to manage Electrolyte and acid base derangements; osmolarity and osmolality.
- Demonstrate acquisition of skills to initiate mechanical ventilation; select appropriate type and mode of ventilator; and monitor proper functioning of ventilator.
- Identify the need to perform intra-operative laboratory tests, blood gases, coagulation profile and interpret the results with clinical correlation
- Demonstrate ability to manage co-morbid conditions and anaesthesia
- Demonstrate ability to perform cannulation of arteries, central and peripheral veins.
- Demonstrate ability in using and interpreting the following routine non-invasive and invasive monitors intra-operatively:
 - a. Electrocardiogram with ST-segment analysis
 - b. Noninvasive blood pressure
 - c. Capnograph: values and changes in values and waveform.
 - d. Pulse oximetry: values and changes in values
 - e. Neuromuscular blockade monitor
 - f. Invasive arterial pressure: waveform and changes in the waveform
 - g. Central venous pressure: values and waveform
 - h. Pulmonary artery pressure: Values and waveforms, pulmonary capillary wedge tracing.
 - i) Cardiac output
 - ii) Mixed venous oxygen saturation
 - iii) Evoked potential
 - iv) Transesophageal echocardiography: basic understanding
- Demonstrate skills in providing basic life support, advanced cardiac life support, trauma life support and paediatric-neonatal life support, train medical and paramedical staff in BLS and ALS.
- Demonstrate mastery in common procedures like vascular access, use of latest invasive and non-invasive monitoring equipment, lumbar puncture, management of appropriate mechanical ventilation and total care of Intensive Care Patient.
- Demonstrate ability to administer general anaesthesia and regional anaesthesia for ASA I to V, under supervision.
- Demonstrate ability to give extradural block (EDB) lumbar and thoracic, Spinal Block, and Peripheral Nerve Blocks under supervision.
- Demonstrate ability to use ultrasound machine for giving blocks and venous cannulation.
- Demonstrate ability to plan and administer anaesthesia to all emergency patients under supervision including patients for Cardiac, Neurosurgery, Pediatric surgery,

and for all major surgeries, able to manage critically ill patients and treat intractable pain.

- Demonstrate following abilities in **Emergency Anaesthesia, Trauma and Resuscitation:**
 - ❖ Organize resources in case of mass casualty.
 - ❖ Perform triage.
 - ❖ Assess, transport and manage mass casualties / disaster management and camp anaesthesia.
 - ❖ Manage massive haemorrhage and massive blood transfusion.
 - ❖ Transport critically ill patient.
 - ❖ Perform anaesthetic management of geriatric patients with fracture neck of femur
 - ❖ Manage severe burns patients, rapidly progressing spinal compression, massive haemoptysis and lobectomy, peritonitis from various suspected causes, preparation and management of bowel obstruction, septicaemic shock, acute upper airway obstruction such as foreign body, epiglottitis, infections, cardiac tamponade from examples post cardiac surgery, malignant pericardial effusion, peri-operative management of rupture aneurysm of abdominal aorta
 - ❖ Basic Cardiac Life Support and Advanced Cardiac Life Support, Basic Trauma Life Support, Advanced Trauma Life Support, and Cerebral preservation.
 - ❖ Management of intra-operative cardiac arrest
 - ❖ Management of intra-operative bronchospasm
- Demonstrate ability to document a Medico-legal aspect.
- Demonstrate ability to provide special sedation /**anaesthesia requirements outside operating Room**, eg **Radiology**: for CT, MRI (especially in relation to dye allergy and embolization, **Onco radiotherapy**, **Electroconvulsive shock therapy** (modified ECT. **Non-invasive cardio-radiologic procedures** including balloon angioplasty and cardiac catheterization, **Non-invasive neuro-radiologic procedures**, **lithotripsy** etc .
- Demonstrate ability to analyze data and write a thesis, present scientific data, participate in anaesthesia audit.
- Demonstrate ability to critically review and acquire relevant knowledge from the journals about the new development in the specialty
- Demonstrate following abilities in the **Post Anaesthesia Care Unit (PACU)**
 - ❖ Assess the patient's recovery and condition for a safe discharge or transfer.
 - ❖ Observe, recognize and treat the commonly occurring problems likely to arise in the Post-anaesthesia Care Unit (PACU) especially those in relation to cardio-respiratory systems:
 1. Airway integrity and compromise.

2. Arrhythmia
 3. Hypertension
 4. Hypotension
 5. Pain prevention and pain relief
 6. Nausea and vomiting
 7. Decreased urine output
 8. Emergence delirium
 9. Delayed emergence from anaesthesia
 10. Shivering
 11. Post-obstructive pulmonary edema.
- ❖ Assess patient recovery and the parameters for transfer from the PACU to the ward, ICU, home.
 - ❖ Score the patient's condition according to the Aldrete system, including fast tracking after out-patient surgery.
- Demonstration of following abilities in **Intensive Care Unit**
 - ❖ **Understanding the spectrum of critical illnesses requiring admission to ICU.**
 - ❖ Recognizing the critically ill patient who needs intensive care -Trauma, burns, all types of shock, Sepsis, SIRS and ARDS, Poisoning, infectious patient (HIV, Hepatitis) and patients with metabolic disturbances.
 - ❖ Monitoring progress of patients by physiological scoring systems
 - ❖ Practicing infection control practices and control of nosocomial infections.
 - ❖ Inserting central venous lines, arterial lines using ultrasound and interpreting the data.
 - ❖ Managing cardiovascular instability, respiratory failure and postoperative pulmonary complications
 - ❖ Understanding of the operation of mechanical ventilators including different ventilatory modalities non-invasive ventilation, complications and modes of weaning.
 - ❖ Principles and application of Oxygen Therapy
 - ❖ Glycemic control in the critically ill patient
 - ❖ Practice of Hypothermia and prevention of cerebral injury after cardiac arrest
 - ❖ Delivering appropriate nutritional support - enteral and parenteral.
 - ❖ Proper use of sedative/hypnotic drugs in the ICU.
 - ❖ Practicing ethical and legal aspects of critical care
 - ❖ Good communication skills with patient and relatives.
 - ❖ Proper Sterilization of ICU equipment.

- Demonstration of following abilities in **Acute and Chronic Pain Management**
 - ❖ Assessment of patients with pain including: history taking, physical examination, and interpretation of investigations.
 - ❖ Classify types of pain - acute chronic, traumatic, cancer pain, etc. with the knowledge of Pain pathways in detail.
 - ❖ Practice the different modalities of physical therapy that may relieve both acute and chronic pain
 - ❖ Practice the acute pain, cancer pain guidelines and WHO treatment ladder.
 - ❖ Practice routes of administration and risk/benefits of drugs used for acute and chronic pain relief, patient controlled analgesia and treat the common pain syndromes.
 - ❖ Demonstrate practice of pain management in patients with problem drug use, drug dependency and addiction and identify the parameters for referral to a pain medicine specialist.
- Demonstrate Organization of acute pain service and role of acute pain nurse for pain assessment in various groups of patients, Physiological changes secondary to Pain, practice different modalities of pain control. Pharmacology and side effects of opioid analgesia and non-opioid analgesia, principle of patient-controlled analgesia and assessment of its efficacy, Pharmacology and side effects of epidural/intra-thecal opioid. Neurological assessment of epidural blockade and management of failed block. Management of regional blockade – brachial plexus, para-vertebral and intra-pleural block. Management of epidural abscess. Substance abuse and acute pain control. Pain control in concurrent medical diseases – COAD, IHD, bleeding tendency, geriatric. Pain control in burns patients. Pain control in trauma patients included multiple rib fracture
- Demonstration of abilities to manage **Chronic Pain**
 - ❖ Practice different modalities of chronic pain management - physical therapy, psychotherapy, (including cognitive behavioural approaches), neuro-ablation, neuro-augmentation, spinal opioid, interventional neuro-blockade, non-opioid analgesia.
 - ❖ Anatomy, indication, technique and complication of chemical sympathectomy (lumbar sympathectomy, stellate ganglion block, celiac plexus block).
 - ❖ Practice principles of management of cancer pain, principle of management of non-cancer neuropathic pain - phantom limb pain, post-herpetic neuralgia, complex regional pain syndrome, trigeminal neuralgia. Principle of management of non-cancer nociceptive pain - myofascial pain, lower back pain, intractable angina, burns, chronic pancreatitis, PVD.
 - ❖ Practice Epidural steroid injection (all levels) and long-term epidural catheterization.
 - ❖ Observe and practice following blocks: Infra-orbital nerve, Intercostal nerve

- ❖ Recognize complications associated with each blocks and know appropriate treatment of each
 - ❖ Know the indications for stimulation techniques such as transcutaneous electrical nerve stimulation (TENS), dorsal column stimulation, and deep brain stimulation.
 - ❖ Mechanisms and side effects of other therapies used for treating pain.
 - ❖ The principles of pain management in special patient groups including the elderly, children, disabled, intellectually handicapped and those unable to communicate.
 - ❖ Awareness of the principles for insertion and management of implantable drug delivery pumps.
 - ❖ Awareness of the basic principles of palliative care.
- **Demonstrate practice of Regional Anaesthesia**
 - ❖ Applying general principles of pharmacology of local anaesthetics and various adjuvants.
 - ❖ Familiarizing with the relevant anatomy for regional techniques.
 - ❖ Application of indications and contraindications to regional anesthetic technique including central neuraxial blocks, peripheral nerve blocks and sympathetic nerve blocks.
 - ❖ Assessing adequacy of regional anaesthesia, and learn techniques of supplementation of inadequate blocks.
 - ❖ Providing effective anxiolytics and sedation of patients by both pharmacologic and interpersonal technique.
 - ❖ Performing the following regional anaesthesia techniques:
 - Brachial plexus, cervical plexus, stellate ganglion block, lumbar plexus, lumbar sympathetic, Sciatic nerve block, Femoral nerve block, 3 in 1 block, Wrist block, Popliteal Nerve block, Trigeminal nerve block, Retro bulbar blocks, Paravertebral blocks, Intercostal blocks, Caudal block – adult and pediatric, Ankle block, Epidural block/Catheter, Subarachnoid block, Bier's block, All peripheral nerves of the upper and lower limbs.
- **Demonstrate practice of Thoracic Anaesthesia**
 - ❖ Pre-operative assessment of patients undergoing Thoracotomy (lung resection), thoracoscopy, video assisted thoracoscopy and mediastinoscopy
 - ❖ Various approaches and their relevant equipments for lung isolation.
 - ❖ Various double lumen tubes and their placement.
 - ❖ Application of Principle of chest drain.
 - ❖ Respiratory Physiology and management of one lung ventilation (OLV). Indications, contraindications and hazards of OLV.

- ❖ Application of the knowledge of Anatomy of lung and broncho-pulmonary segments.
 - ❖ Anatomy and techniques for intercostals nerve block and thoracic epidural. Management of thoracic epidural anaesthesia and analgesia
 - ❖ Anatomy, techniques and placement of paravertebral block/catheter.
 - ❖ Post-operative care of patients after lung surgery.
 - ❖ Peri-operative management of patients with myasthenia gravis.
 - ❖ Peri-operative management of patients with mediastinal mass.
 - ❖ Anaesthetic management of mediastinoscopy, major airway stenting.
 - ❖ Lung volume reduction surgery and problems.
- **Demonstrate practice of Cardiovascular Anaesthesia:**
 - ❖ Application of the knowledge of Anatomy and physiology of valvular disease, coronary arteries and their territories. Pulmonary circulation, coronary circulation, cerebral circulation, visceral circulation.
 - ❖ Application of the knowledge of Distribution of blood volume to different organs and systems and their control. Microcirculation. Venous system, venous pressure, its influence on various functions.
 - ❖ Regulation of blood pressure, hypotensive anaesthesia.
 - ❖ Anatomy and physiology of all operable congenital heart disease like ASD, VSD, PDA, TOF, transposition of great vessels.
 - ❖ Application of the knowledge of anatomy and physiology of vascular heart disease like co-arctation of aorta.
 - ❖ Assessment of cardiac patient with ischaemic heart, valvular heart disease and other diseases listed above. Understanding of cardiac catheterization, echocardiography, stress testing, and radio-nucleide imaging.
 - ❖ Application of Principle and complication of cardiopulmonary bypass
 - ❖ Application of Principle of trans-esophageal echocardiography
 - ❖ Application of Principle of circulatory support: inotropes, IABP, pacing
 - ❖ Coagulation and management of coagulopathy.
 - ❖ Off pump bypass
 - ❖ Intra-operative management of aortic surgery and major peripheral vascular surgery, aneurysm grafts, recanalisation procedures.
 - ❖ Understanding of the adult patient with congenital heart disease and their management during anaesthesia.
 - ❖ Postoperative cardiac critical care, including cardiovascular problems, analgesia.
 - ❖ Insertion of invasive monitoring for arterial monitoring, central venous pressure monitoring, pulmonary artery catheter insertion and interpretation.
 - ❖ Robotic cardiac surgery.

- **Demonstrate practice of Paediatric Anaesthesia**
 - ❖ Application of knowledge of Anatomical changes in paediatric patient and neonates.
 - ❖ Application of knowledge of Physiology and pharmacology in paediatric patient.
 - ❖ Guideline for pre-operative fasting in children and pre-medication.
 - ❖ Anaesthetic equipment: laryngoscopes, airways, endotracheal tubes, LMAs, PLMA and breathing circuit for children.
 - ❖ Anaesthesia management for premature and newborn.
 - ❖ Emotional problems for parent and child and principles of premedication. Consent by parents and their presence during induction. To become skilled in communicating with children, parents and other relatives.
 - ❖ Problems of transporting a sick pediatric patient from the ward to the operating room and back with regard to temperature maintenance, cardiovascular stability, ventilation and oxygenation.
 - ❖ Estimate preoperatively blood volume, hourly fluid requirements, fluid deficit, third space loss, acceptable blood loss and apply principles of fluid and blood replacement in the perioperative period.
 - ❖ Induce and maintain anaesthesia by inhalation, intravenous, intramuscular and rectal routes and monitor pediatric patients.
 - ❖ Understand the benefits, risks and techniques of regional anaesthesia in children. Anatomy and techniques of caudal, dorsal penile and inguinal regional block, spinal and epidural block
 - ❖ Learn to recognize and treat post anaesthesia complications like apnea, laryngospasm, acid-base and electrolyte disturbances, febrile and convulsing child and bleeding child.
 - ❖ Common problems related to common congenital syndromes presenting for surgery. Anaesthetic management of a child with concurrent disease – Down's, Pierre Robin syndrome, von Willebrand's disease, Goldenhar's, Sturge-Weber, Tracher-Colin, Prune-Belly, and cyanotic and non-cyanotic congenital heart disease.
 - ❖ Paediatric resuscitation: drugs, doses and defibrillation of children of all ages, from the very premature neonates to those children with complex coexisting disease.
 - ❖ Management of patients requiring paediatric intensive care, ventilatory management, and support of circulation.
 - ❖ Resuscitation of neonates and children of all ages. A period of one to two months in a PICU is recommended for all post graduate students undergoing advanced training in paediatric anaesthesia.
 - ❖ Paediatric pain management
 - ❖ Assessment of a child with URTI, with a heart murmur.
 - ❖ Management of fluid and electrolytes in children.

- ❖ Anaesthetic management of a malignant hyperthermia susceptible child.
- ❖ Anaesthetic management of FB bronchus, oesophagus, Wilm's tumour, congenital diaphragmatic hernia, tracheo-oesophagus fistula, thoracotomy.
- ❖ Anaesthesia for Fetal Surgery.
- ❖ Sedation techniques including the selection, management and monitoring of children for diagnostic and therapeutic procedures, with particular attention to working in areas outside the theatre suite.
- **Demonstrate practice of Transplant anaesthesia**
 - ❖ Application of knowledge of basic pathophysiology of renal and liver failure. Principles of anesthetizing an immuno-compromised patient.
 - ❖ Principles of anesthetizing patient with end stage renal/liver disease and patient with organ transplantation. Perioperative management.
- **Demonstrate practice of Neuroanaesthesia**
 - ❖ Application of basic knowledge of cerebral circulation and intra cranial pressure and its implications
 - ❖ Anaesthesia to patients with neurologic disease, head injury undergoing neurologic or non-neurologic surgery and for diagnostic procedures requiring anaesthesia.
 - ❖ Anesthetic implications of the most common neurosurgical procedures, transnasal, trans-sphenoidal pituitary surgery. Posterior fossa surgery. Surgery for supratentorial pathology.
 - ❖ Application of basic concepts behind electrophysiologic monitoring of the brain and spinal cord.
 - ❖ Application of knowledge of general principles of positioning the patient for surgery and the advantages and disadvantages of each position.
 - ❖ Effects of anaesthesia on the electroencephalogram (EEG) and evoked potentials.
 - ❖ Differential diagnoses and treatment alternatives of intraoperative intracranial hypertension (“tight brain”)
 - ❖ Management of Head Trauma, and its anesthetic management and various protocols regarding their management and associated trauma.
 - ❖ Intracranial surgery and spinal surgery, both routine and emergency.
 - ❖ Monitoring: techniques for detection and management of air embolism.
 - ❖ Lumbar puncture and CSF drainage.
 - ❖ Non-surgical management of the head trauma patient, Systemic complications of severe brain injury.
 - ❖ Management of subarachnoid haemorrhage and vasospasm.
 - ❖ Diagnosis and management of patients with brainstem death; and dealing with patient's relatives

- **The following are special procedures which the post graduate student must be able to perform**

Sr. No.	Name of procedure
1.	Blind Nasal intubation
2.	Failed intubation drill (includes Fiberoptic Laryngo/ Bronchoscope)
3.	Double Lumen Tube
4.	Bronchial Blocker placement
5.	Jet Ventilation
6.	Suctioning and physiotherapy of wet lung
7.	Intubation in Neonates
8.	Initiation and management of ventilation
9.	Combined Spinal Epidural
10.	Brachial Plexus Block
11.	Intravenous Regional Anaesthesia
12.	Elbow, Wrist, Digital, Sciatic, Femoral, Lateral Cutaneous Nerve of thigh, Ankle - each
13.	Cervical-Superficial and Deep, Stellate, Splanchnic - each
14.	Central Venous Line by Brachial, Jugular and Subclavian veins
15.	Radial and Femoral Artery cannulation
16.	CVP monitoring
17.	Pulmonary Capillary Wedge Pressure
18.	Neuro-muscular transmission Monitoring
19.	Anaesthetic Depth eg. BIS monitoring

- Demonstration of anesthetic abilities in the intraoperative period keeping into consideration the specific requirement of the surgical procedure – ENT, Orthopaedic, Gynaecology – Obstetrics, General surgery, Onchosurgery, replacement surgeries, urosurgery, vascular, plastic, Thoracic, Dental etc

Suggested Time Frame for Training the PG Students:

The student should be taught as per the following schedule to acquire the skills:

1. First 6 months:

- During the first 6 months, the student should be taught expertise in the management of uncomplicated cases not belonging to any super specialty (ASA I and II cases). To start with, the student will observe and slowly become independent in giving general anaesthesia and spinal anaesthesia to ASA I and II cases for minor and major surgery, under graded supervision.
- The postgraduate student should learn the basic principles of safe and effective anaesthesia, resuscitation, and both the prevention and treatment of pain,

perioperative care of the surgical patient, care of handling equipments, basic techniques in anaesthesia, and anaesthetic pharmacology, and electrical safety.

- He/she should select the thesis topic and submit the protocol for his thesis.

2. Next 18 months

- The student should widen his experience and should be able to undertake anaesthetic care of all routine cases, assist in the anaesthetic care for routine obstetric practice, understand basic principles of critical care, pain management, and participate in audit.
- The student should be trained in administration of general anaesthesia and regional anaesthesia for ASA I to V under supervision. The student should be able to give extradural block (EDB) lumbar and thoracic, Spinal Block, and Peripheral Nerve Blocks under supervision, and use of Ultrasound machine for giving blocks and venous cannulation. The student should learn paediatric and trauma life supports and maintain skills for basic and advanced cardiac life support.
- It is advised that they should be posted in the following specialties: general surgery including gastrointestinal surgery, transplant, ENT, Urology, Obstetrics, Dental Surgery, Eye, ICU, Pain Clinic and peripheral theatres like ECT, radiodiagnostic and therapeutic procedures (CT scan, MRI scan, angiography).
- The student should be able to analyze data and write a thesis. He/she should be able to present scientific data.

3. Last 12 months

- Thesis should be submitted minimum of 6 months before the final MD examination.
- The post graduate student should be given experience of various super-specialties like cardiothoracic and vascular surgery, neurosurgery and transplantation, and paediatric surgery. The student should be able to plan and administer anaesthesia to all emergency patients under supervision including patients for Cardiac, Neurosurgery, Pediatric surgery, and for all major surgeries. The aim at the end is to be competent and independent soon after the third year of junior residency in providing anaesthesia to elective and emergency cases.
- The post graduate student should be able to manage critically ill patients and treat intractable pain. They should also know how to organize resources in case of mass casualty. The curriculum should be able to provide 04 months of elective Intensive Care Unit posting (2 months during initial years under supervision and 2 months independently in the last six months).

4. At the end of 3 years, the post graduate student should have the skills to:

- Plan and conduct anaesthesia and provide post-operative care including pain relief for elective and emergency surgical procedures related to all surgical specialties.

- Carry out basic life support (BLS) and advanced life support (ALS) and train medical and paramedical staff in BLS and ALS.
- Manage patients admitted to an intensive care unit with the help of latest equipment.
- Manage patients suffering from acute and chronic intractable pain.
- Organize the hospital environment to manage mass casualty situation and camp anaesthesia.
- Critically review and acquire relevant knowledge from the journals about the new development in the specialty.
- Should be able to participate in anaesthesia audit.

Overall the student should acquire skills in the following practical competencies:

- ❖ Information management in preoperative evaluation and outcome enhancement and communication skill to patient and relatives.

COURSES OUTCOMES

Syllabus

The course content of **1st year** should cover the following:

1. **Anatomy related to:**

- Diaphragm, upper and lower airway
- Regional anaesthesia, field block, central neuraxial, blockade, block for acute pain states
- Intramuscular injections, arterial and venous cannulations and positioning.

2. **Physics related to:**

- Anaesthesia machine - assembly of necessary items.
- Airway equipment including laryngoscopes, airway devices
- Breathing systems
- Monitoring in anaesthesia with concepts of minimum monitoring
- Gas laws, medical gas supply system
- Fluidics
- Electricity and diathermy
- Oxygen therapy

3. **Physiology related to:**

- Theories of anaesthesia
- Respiratory, cardiovascular, hepatobiliary, renal and endocrine system, pregnancy, blood, muscle and N-M junction, Nerve impulse transmission, ECG, regulation of temperature and metabolism, stress response, cerebral blood flow and ICP.

- Central, autonomic and peripheral nervous systems.
- Metabolic response to stress and trauma.

4. **Pharmacology related to**

- General principles, concepts of pharmacokinetics and pharmacodynamics
 - Drug interactions in anaesthesiology, anaphylactoid reactions
 - Drugs used for premedication, induction of anaesthesia, general anaesthetics-intra-venous and inhalational, neuromuscular block and reversal of muscle relaxants.
5. **Biochemistry** relevant to fluid balance and blood transfusion, perioperative fluid therapy, acid base homeostasis in health and diseases.
 6. Theoretical background of the commonly used anaesthetic techniques of general and regional anaesthesia, general principles of pre-anesthetic assessment and medication, recovery from anaesthesia and post operative care, effects of positioning during anaesthesia.
 7. Introduction to the operation theatre, post-anaesthesia care rooms
 8. Introduction to acute, chronic pain and pain management.
 9. Documentation and medico-legal aspects of anaesthesia. Defensive anaesthesia. Concept of informed consent.
 10. Resuscitation - basic and advanced life support (cardiac and trauma life support), neonatal resuscitation.
 11. Intensive care of critical patients with introduction to artificial ventilation, management of unconscious patients, oxygen therapy, shock - pathophysiology and management.
 12. Introduction to Research methodology, basics of biostatistics.

The course content of **2nd year** should cover the following:

Anatomy related to blocks for chronic pain, chemical neurolysis and different organ systems.

1. **Physics related to:**

- equipments used in anaesthesia monitors, ventilators, vaporizers,
- fiberoptics.
- Laser
- Pacemaker and defibrillator
- Monitoring equipment used for assessment of cardiac functions, temperature, respiratory functions, blood gases, intracranial pressure, depth of anaesthesia and neuromuscular block.
- Sterilization of equipment
- Computers in anaesthesia

2. Pharmacology of drugs used in cardiovascular, respiratory, endocrine, renal diseases and CNS disorders.
3. Interpretation of blood gases and other relevant biochemical values, various function tests and basics of measurement techniques, ECG.
4. Blood coagulation mechanism, disturbances, blood components.
5. Special anaesthetic techniques as relevant to –
 - Outpatient anaesthesia, hypotensive anaesthesia, anaesthesia in abnormal environments including rural area and calamitous situations
 - Associated medical disorders in surgical patients
6. Geriatric and pediatric anaesthesia
7. Emergency, ENT, orthopedic, ophthalmology, obstetrics, dental, radio-diagnosis and radiotherapy.
8. Medical statistics relevant to data collection, analysis, record keeping in anaesthesia, comparison and estimation of significance.
9. Care of terminally ill, Hospices management. Do not resuscitate orders.
10. Postures and anaesthesia.
11. Induced hypothermia, incidental, environmental safety of patient.
12. Malignant hyperthermia, myasthenia gravis, GB syndrome and other neuromuscular diseases, obesity, COPD, Diabetes mellitus, bronchial asthma and hypertensive crises..
13. Third world anaesthesia.
14. Inherited metabolic diseases and anaesthesia.

The course contents of **3rd year** should cover the following:

1. Principles of anaesthetic management of neuro/cardiac/thoracic/vascular/transplantation/burns and plastic surgery.
2. Anaesthesia for patients with severe cardiac, respiratory, renal and hepatobiliary disorder posted for unrelated surgery
3. Shock, types, pathogenesis and management of patients in shock, renal failure, critically ill and/or on ventilator.
4. Multiple organ failure
5. Infection control, cross contamination in OT and ICU.
6. Immune response and anaesthesia.
7. Concept of cytokines, and other enzymes.
8. Selection, maintenance and sterilization of anaesthesia and related equipment
9. Chronic pain therapy and therapeutic nerve blocks.
10. Acupuncture, acupressure and other non-conventional methods of treatment.
11. Principles of neonatal resuscitation, ventilation and critical care.
12. Principles of human resources and material management.

13. General principles of medical audit. Critical incident reporting
14. Ethics and clinical trial.
15. Hospital, ICU and OT design and planning.
16. Medical education including evidence based medical education.

MD-RADIODIAGNOSIS

Program Outcomes

The objective of the program is to train a student to become a skilled and competent radiologist to conduct and interpret various diagnostic/interventional imaging studies (both conventional and advanced imaging), to organize and conduct research and teaching activities and be well versed with medical ethics and legal aspects of imaging/intervention.

Cognitive based

The student should be able to:

- PO1. Understand basics of X-ray production, its uses and hazards.
- PO2. Appreciate and diagnose changes in bones -like fractures, infections, tumours and metabolic bone diseases.
- PO3. Identify and diagnose various radiological changes in disease conditions of chest and mediastinum, skeletal system, G.I. Tract, Hepatobiliary system and G.U. system.
- PO4. Learn about various imaging techniques, including isotopes C.T., Ultrasound, M.R.I. and D.S.A.

Skills

At the end of the course the student should be able to:

- PO5. Use basic protective techniques during various imaging procedures.
- PO6. Interpret common X-ray, radio-diagnostic techniques in various community situations.
- PO7. Advise appropriate diagnostic procedures in specialized circumstances to appropriate specialists.

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive Domain

A post graduate student on completing MD (Radiodiagnosis) should acquire knowledge in the following areas, and be able to:

1. Acquire good basic knowledge in the various sub-specialties of radiology such as chest radiology, neuro-radiology, GI-radiology, uro-radiology, cardio-vascular-radiology, musculoskeletal, interventional radiology, emergency radiology, pediatric radiology and women's imaging.

2. Independently conduct and interpret all routine and special radiologic and imaging investigations.
3. provide radiological services in acute emergency and trauma including its medico-legal aspects.
4. Elicit indications, diagnostic features and limitation of applications of ultrasonography, CT and MRI and should be able to describe proper cost-effective algorithm of various imaging techniques in a given problem setting.
5. Decide on the various image-guided interventional procedures to be done for diagnosis and therapeutic management.
6. Able to decide on further specialization to be undertaken in any of the branches in Radiodiagnosis such as gastrointestinal radiology, uro-radiology, neuro-radiology, vascular radiology, musculoskeletal radiology, interventional radiology etc.
7. Able to formulate basic research protocols and carry out research in the field of radiology- related clinical problems.
8. Acquire knowledge and teaching capabilities to work as a post graduate student /consultant in Radiodiagnosis and conduct teaching programmes for undergraduates, post graduates as well as paramedical and technical personnel.
9. interact with other specialists and super-specialists so that maximum benefit accrues to the patient.
10. Should be able to organize CME activities in the specialty utilizing modern methods of teaching and evaluation.
11. Acquire knowledge to impart training in both conventional radiology and modern imaging techniques so that the post graduate student is fully competent to practice, teach and do research in the broad discipline of radiology including ultrasound, Computed Tomography and Magnetic Resonance Imaging.
12. Acquire knowledge of interventional radiology.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

Practical Training will include two major aspects:

- A) Interpretation of images, and
- B) Skill in performing a procedure.

A) Interpretation of images:

The student should be able to interpret images on all imaging modalities of diseases of following organs :

1. **Musculo-skeletal System** - Interpretation of diseases of muscles, soft tissue, bones and joints including congenital, inflammatory, traumatic, endocrine and metabolic, neoplastic and miscellaneous conditions.
2. **Respiratory System** - Interpretation of diseases of the chest wall, diaphragm, pleura and airway; pulmonary infections, pulmonary vasculature; pulmonary neoplasm; diffuse lung disease; mediastinal disease, chest trauma; post-operative lung and X-ray in intensive care.
3. **Cardiovascular System** - Interpretation of diseases and disorders of cardiovascular system (congenital and acquired conditions) and the role of imaging by conventional radiology, ultrasound, colour Doppler, CT, MRI, Angiography and Isotopes Studies.
4. **Gastro-intestinal tract and hepato-biliary pancreatic system** - Interpretation of diseases and disorders of mouth, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, diseases of omentum, peritoneum and mesentery: acute abdomen, abdominal trauma. Diseases and disorders of liver, biliary system and pancreas.
5. **Urogenital System** - Interpretation of various diseases and disorders of genitor-urinary system. These include: congenital, inflammatory, traumatic, neoplastic, calculus disease and miscellaneous conditions.
6. **Central Nervous System (C.N.S.)** - Interpretation of diseases and disorders of the head, neck and spine covering, congenital, infective, vascular, traumatic neoplastic degeneration metabolic and miscellaneous condition.
7. Imaging in Emergency Medicine.
8. Imaging in Obstetrics and Gynecology.
9. Imaging of Breast and interventional procedures.
11. ENT, EYE and Dental Imaging.
11. Imaging of endocrine glands and those involved with metabolic diseases.
12. Clinical applied radionuclide imaging.
13. Interventional Radiology

B) Skills in performing a procedure

The student should be able to perform the following procedures:

- 1) **GIT contrast studies:** Barium studies (swallow, upper GI, Follow through, enema);

- fistulogram; sialogram; cologram/ileostogram,
- 2) **GU:** Excretory urography, MCU, RGU, nephrostogram, genitogram,
 - 3) **Ultrasound:** Studies of whole body including neonatal transfontanell studies, Doppler studies,
 - 4) **CT scan:** should be able to position a patient, plan study as per the clinical indication, do reconstruction of images, perform triple phase study, perform & interpret advanced applications like CT enterography, CT angiography etc.
 - 5) **MRI:** plan and perform MRI studies of whole body
 - 6) **DSA:** should be able to describe the techniques, do (if available to student) transfemoral puncture and insert catheter, help in angiographic procedures both diagnostic and interventional.
 - 7) **Radiography:** should be able to independently do radiography of common and some important uncommon views of different body parts. This includes positioning, centering of X ray beam, setting of exposure parameters, exposing and developing the films. The student should be familiar with not only conventional radiography but with CR and DR systems.
 - 8) **Interventional radiology:** The student should be able to perform simple, common non-vascular procedures under ultrasound and fluoroscopy guidance e.g. abscess drainage, drainage catheter placement, nephrostomy, biliary drainage etc. The student should have knowledge of common vascular interventions e.g stricture dilatation using balloon catheters, embolization with gel foam and other agents, names of common catheters, handling of intravenous contrast reactions; techniques, indications and contraindications for various procedures;

COURSES OUTCOME

Syllabus

Course contents:

Anatomy

Gross and cross sectional anatomy of all the body systems.

Pathology

Gross morphology of pathological conditions of systemic diseases affecting all organ systems.

Radiology Course

This would cover imaging and interventions of diseases affecting all the body systems:

- Chest
- Cardiovascular system
- Musculoskeletal including soft tissue
- Gastrointestinal system
- Hepato-biliary-pancreatic system
- Urogenital (genito-urinary) system

- CNS including head and neck
- Obstetrics and gynaecology
- ENT, eye, dental, breast
- Endocrine and metabolic system
- Clinically applied radionuclide imaging

Radiological Physics

1. Introduction of general properties of radiation and matter: Fundamentals of nuclear physics and radioactivity
2. Interaction of x-rays and gamma rays with matter and their effects on irradiated materials
3. X-ray Generating Apparatus
4. Screen-film radiography
5. Film processing: Dark room, dry processing, laser /dry chemistry cameras, artifacts.
6. Fluoroscopy: Digital including flat panel units, fluoroscopy cum radiography units
7. Digital radiography: Computed Radiography, Flat panel radiography
8. Other equipments: Ultrasound including Doppler, CT, MRI and DSA
9. Contrast Media (Iodinated, MR & Ultrasound) - types, chemical composition, mechanism of action, dose schedule, route of administration, adverse reaction and their management
10. Nuclear Medicine: Equipments and isotopes in various organ systems and recent advances
11. Picture Archiving and Communication System (PACS) and Radiology Information System (RIS) to make a film-less department and for Teleradiology
12. Radiation protection, dosimetry and radiation biology
13. Image quality and Quality Assurance (QA)
14. Recent advances in radiology and imaging

The student should have knowledge of the following physics experiments:

- Check accuracy of kVp and timer of an X ray unit
- Check accuracy of congruence of optical radiation field
- Check perpendicularity of x ray beam
- Determine focal spot size
- Check linearity of timer of x ray unit
- Check linearity of mA
- Verification of inverse square law for radiation
- Check film screen contact
- Check film screen resolution
- Determine total filtration of an x ray unit
- Processor quality assurance test

- Radiological protection survey of an x ray unit
- Check compatibility of safe light
- Check performance of view box
- Effect of kVp on x ray output

Radiography and processing techniques

1. Processing techniques: includes dark room and dry processing.
2. Radiography of the musculo-skeletal system including extremities.
3. Radiography of the chest, spine, abdomen and pelvic girdle.
4. Radiography of the skull, orbit, sinuses.
5. Contrast techniques and interpretation of GI tract, hepato-biliary tract, pancreas etc.
6. Contrast techniques and interpretation of the Central Nervous system.
7. Contrast techniques and interpretation of the cardiovascular system including chest.
8. Contrast techniques and interpretation of the genito - urinary system including Obstetrics and Gynaecology.
9. Paediatric radiology including MCU, genitogram, bone age.
10. Dental, portable and emergency (casualty) radiography.